Heating Piping & Air Conditioning

DECEMBER 1954

NDUSTRIAL • COMMERCIAL • INSTITUTIONAL • PUBLIC BUILDINGS

age 113—Journal Section of The American Society of Heating and Ventilating Engineers

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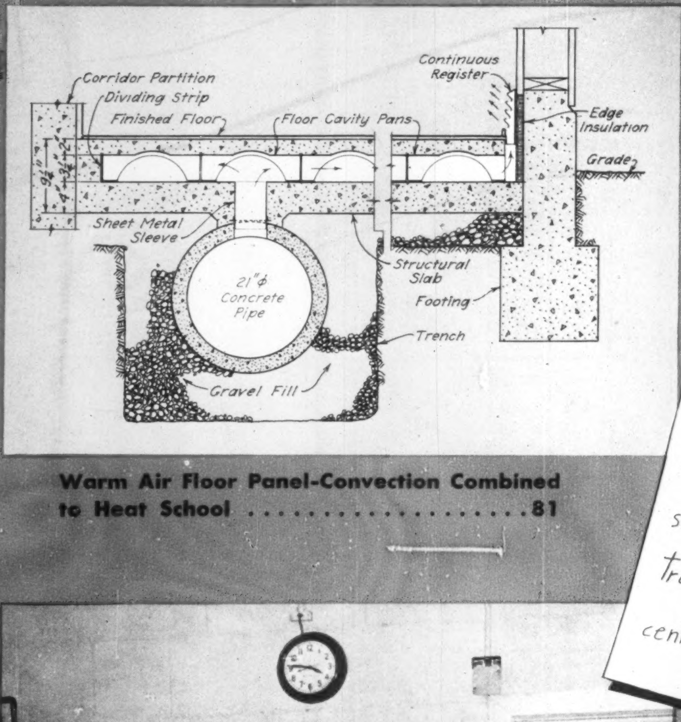
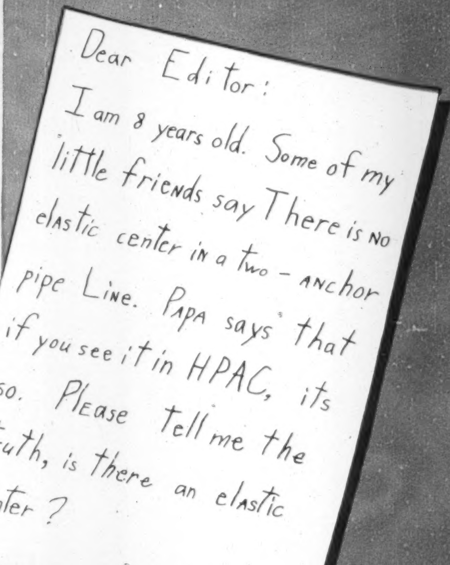

Corridor Partition
Dividing Strip
Finished Floor
Floor Cavity Pans
Continuous Register
Edge Insulation
Grade
9¼"
4
3¼
2
Sheet Metal Sleeve
21" ϕ Concrete Pipe
Structural Slab
Footing
Trench
Gravel Fill

Warm Air Floor Panel-Convection Combined to Heat School 81


Dear Editor:

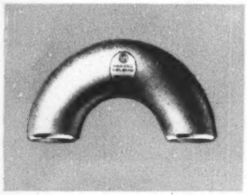
I am 8 years old. Some of my little friends say There is no elastic center in a two - anchor pipe Line. Papa says that if you see it in HPAC, its so. Please tell me the truth, is there an elastic center?

Virginia

Yes — and No, Virginia (Reaction Centers in Piping) 77

Controlling Air Conditions in a Very Small Test Lab 102

*In addition to carbon steel and stainless steel**



GRINNELL WELDING FITTINGS

may be had in

- **WROUGHT IRON**
- **ALUMINUM**
- **INCONEL**
- **PURE NICKEL & MONEL**
- **COPPER (Deoxidized)**
- **HASTELLOY ALLOYS, B & C**

Piping engineers can choose Grinnell Welding Fittings today from numerous materials having exceptional resistance to heat and cold, as well as the ability to cope successfully with troublesome fluids and gases.

Numbered among these are intermediate and high alloy steels containing chromium, nickel (or both)—plus other alloying elements such as molybdenum and copper. In addition, alloys are available which are composed primarily of nickel, copper or aluminum. Hastelloy Alloys B & C, developed primarily for severe chemical service, are also available.

Charted on this page are Grinnell Welding Fittings in a variety of materials and sizes.

**Covered in previous advertisements. Available on request.*

TYPE OF FITTING (All dimensions in inches)		WROUGHT IRON		ALUMINUM[1] Type 3S-F		INCONEL			NICKEL & MONEL			COPPER[2] Deoxidized		HASTELLOY ALLOYS B & C		
		Std. Wall	Ex. Str. Wall	Std. Wall	Ex. Str. Wall	Sch. 10	Std. Wall	Ex. Str. Wall	Sch. 10	Std. Wall	Ex. Str. Wall	Std. Wall	Ex. Str. Wall	Schedule 5	Schedule 10	Std. Wall
ELBOWS	90° Long Radius	½-12	½-12	½-16	½-16	½-12	½-12	½-12	½-12	½-12	½-12	½-24	½-24	½-8	½-8	½-8
	90° Short Radius	....	....	1-16	1½-16	....	....	....	....	....	....	....	....	....	....	....
	45° Long Radius	½-12	½-12	½-16	½-16	½-12	½-12	½-12	½-12	½-12	½-12	½-24	½-24	½-8	½-8	½-8
RETURNS	180° Long Radius	....	....	½-16	½-16	½-12	½-12	½-12	½-12	½-12	½-12	½-24	½-24	....	....	....
	180° Short Radius	....	....	1-16	1½-16	....	....	....	....	....	....	....	....	....	....	....
TEES	Straight Outlet	½-12	½-12	½-16	½-16	½-12	½-12	½-12	½-12	½-12	½-12	½-16	½-16	½ & Larger	½ & larger	½ & larger
	Reducing Outlet	½-12	½-12	½-16	½-16	½-12	¾-12	¾-12	½-12	¾-12	¾-12	¾-16	¾-16	½ & larger	½ & larger	½ & larger
CROSSES	Straight Outlet	....	....	½-12	½-12	....	....	....	....	....	....	....	....	....	....	....
	Reducing Outlet	....	....	½-12	½-12	....	....	....	....	....	....	....	....	....	....	....
REDUCERS	Concentric	1-12	1-12	½-16	½-16	¾-12	¾-12	¾-12	¾-12	¾-12	¾-12	¾-12	¾-12	½ & larger	½ & larger	½ & larger
	Eccentric	1-12	1-12	½-16	½-16	¾-12	¾-12	¾-12	¾-12	¾-12	¾-12	¾-12	¾-12	½ & larger	½ & larger	½ & larger
STUB ENDS	ASA Length	½-12	½-12	½-24	½-24	½12-	½-12	½-12	½-12	½-12	½-12	½-12	½-24	½ & larger	½ & larger	½ & larger
	Short Length	....	....	....	....	½-12	½-12	½-12	½-12	½-12	½-12	....	....	½ & larger	½ & larger	½ & larger
CAPS		¾-12	¾-12	½-24	½-24	½-12	½-12	½-12	½-12	½-12	½-12	½-24	½-24	½ & larger	½ & larger	½ & larger

1. Type 2S-F Alclad, 3S-F, and Type 61S-T6 also available.
2. Red brass, low silicon bronze, admiralty metal, aluminum bronze and other copper alloys available on request.

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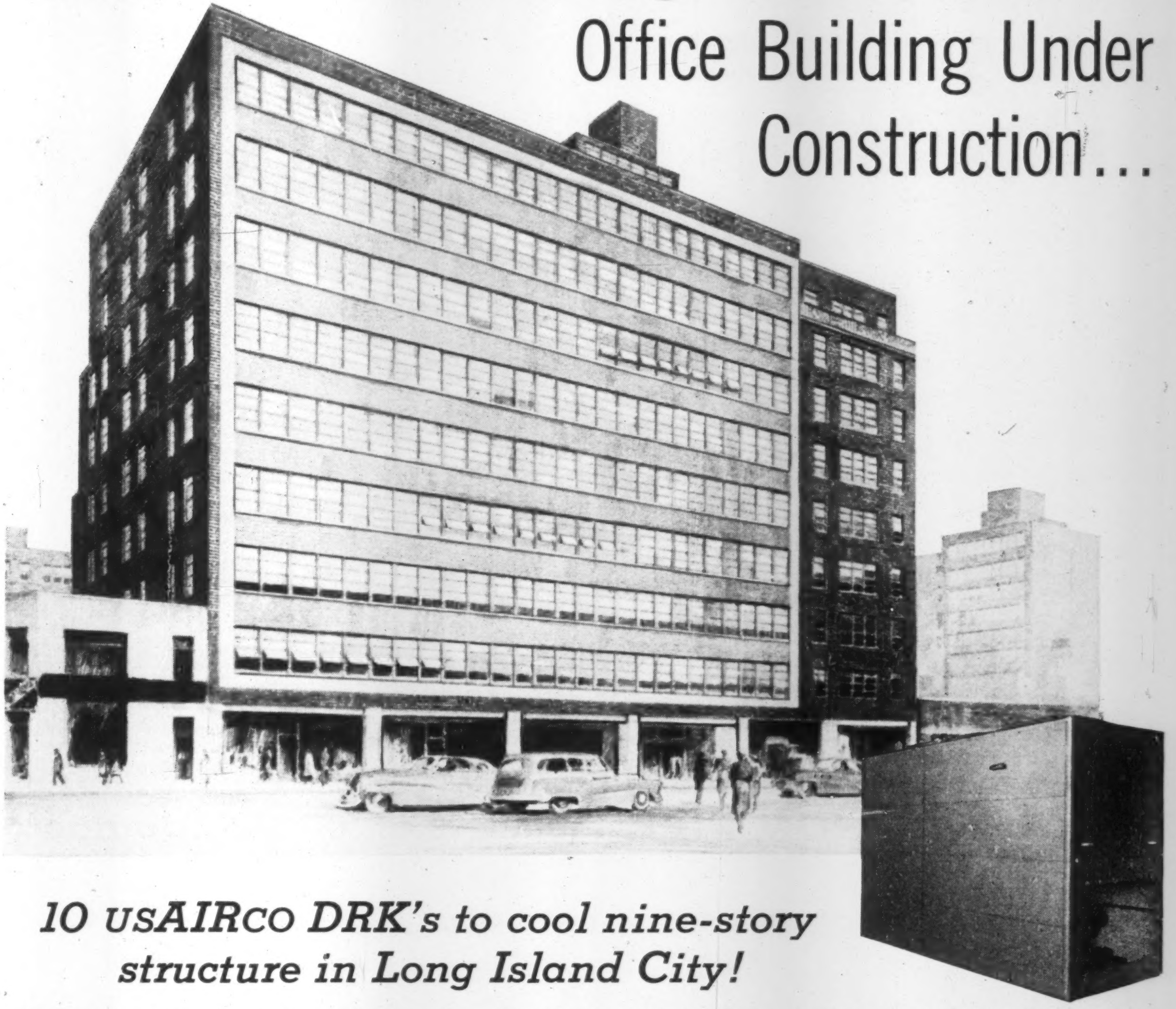
New York's First "Package" Air Conditioned Office Building Under Construction...



10 USAIRCO DRK's to cool nine-story structure in Long Island City!

The first new multi-story rental office building ever to be fully air conditioned by self-contained central station equipment is now under construction at Queens Plaza, Long Island City, New York.

The building has a 150-foot front, a depth of 85 feet and will contain street floor store space, eight rental office floors and a 1,000 square foot penthouse.

As further proof that factory assembled air conditioning plants are increasing in application, the new nine-story and penthouse building will utilize nine 30-ton USAIRCO dual circuit "Refrigerated Kooler-aire" units (DRK) and one 15-ton DRK. Total cooling capacity is 285 tons.

A 30-ton "package" will be located on each of the nine floors, while the 15-ton will serve the penthouse and one section of the ninth floor. Each unit occupies an enclosed equipment room in the central service core of the structure. All the elements of a built-up system—blower section, compressor section and evaporative condenser—are contained in each unit. By using USAIRCO's packaged air conditioning system, no cooling tower is needed on the roof, freeing the penthouse area for rental income. Extensive condenser water piping and refrigerating piping are also unnecessary.

The ten DRK's—with two compressors and two separate refrigeration circuits—were specified for this particular installation because load variations will require definite capacity control. When outside temperature drops, or when fewer people occupy a floor, just one compressor functions. When temperatures are higher and tenancy increased, full capacity is required and both compressors automatically go into operation. Separate refrigeration circuits permit continued dehumidification when the unit operates at reduced capacity.

Fresh air supply and exhaust air will be handled by two shafts running the entire height of the building. Winter heating will be provided by a baseboard system, supplemented by warm air circulated through the air conditioning system.

Under the owner's plan to lease full floors to individual tenants, metering of the equipment will be possible, because each floor's air conditioning system operates independently. Each tenant will control his own equipment, which will be automatically regulated by wall thermostats.

Scheduled for April 1 completion, builder is Depot Construction Corp.; owner, Queens Plaza-Crescent, Inc., both of New York. Wechsler & Schimenti are the architects. J. W. Hubert Corp. is the air conditioning and heating contractor.

USAIRCO
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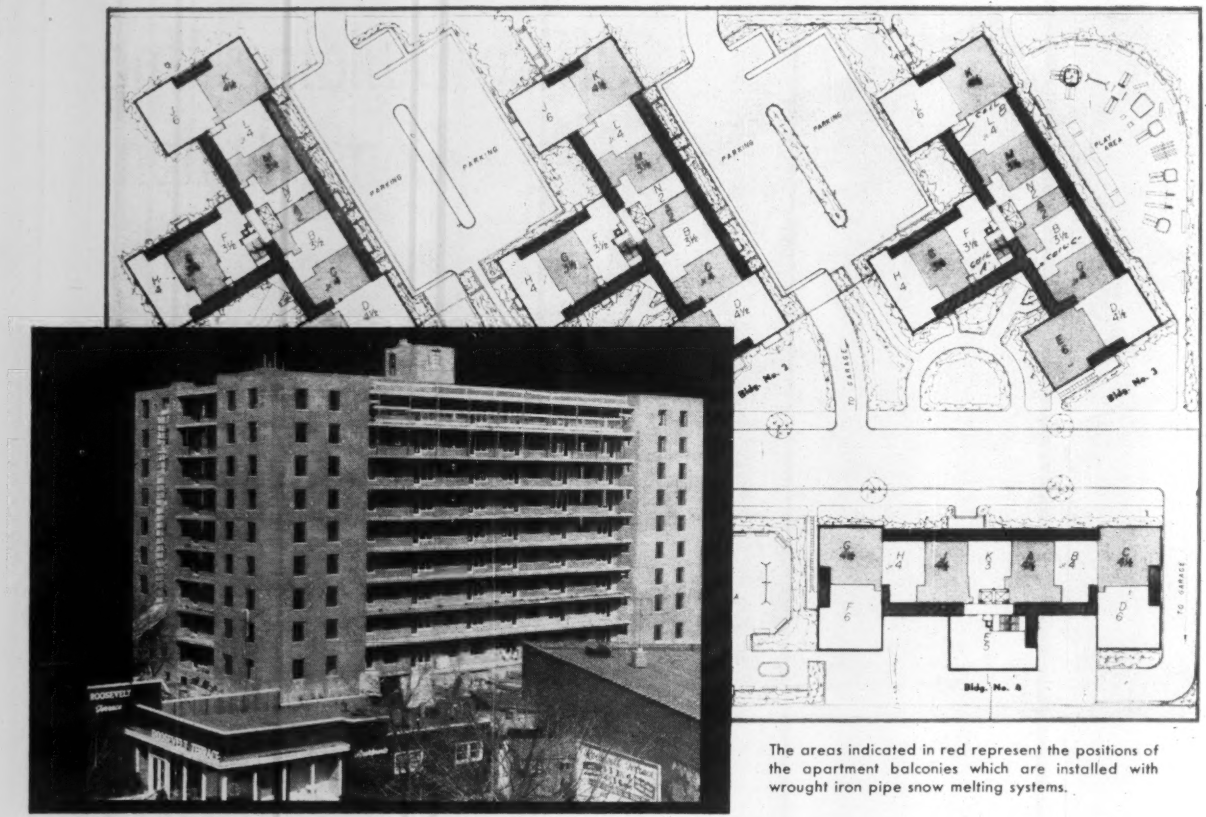
For complete details write Dept. HP-124

UNITED STATES AIR CONDITIONING CORPORATION
MINNEAPOLIS 14, MINNESOTA

SNOW MELTING MOVES UPSTAIRS



The areas indicated in red represent the positions of the apartment balconies which are installed with wrought iron pipe snow melting systems.

WROUGHT IRON PIPE installed on outside corridors of all 9 floors at Roosevelt Terrace

Few architectural achievements have ever depended more heavily on pipe dependability in snow melting systems than the four new Roosevelt Terrace Apartments, Jamaica, New York.

Marking a complete departure from traditional design, these modern structures utilize outside corridors on all nine floors instead of conventional inside halls. Each corridor is the main artery leading from living suites to elevators and stairways. All-important to the success of this unique arrangement was a snow melting system that would effectively and continuously keep the corridors dry and clear of ice and snow during the winter months.

To make sure the occupants would not be inconvenienced with failures, and the owners would not be burdened with repairs, the designers installed corrosion-resistant, wrought iron pipe.

Construction of the projects is under the supervision of Mr. Alfred L. Kaskel, President of Carol Management Corporation, 12 East 48th Street, New York City. Sales agent for the apartments is Carol Enterprise, Inc. Architect, Philip Birnbaum, N.Y.; Mechanical Engineer, Charles Wurmfeld, N.Y.

Our bulletin, *Wrought Iron Pipe for Snow Melting Systems*, discusses a variety of actual installations and answers many problems on modern snow removal methods. Write for your copy.

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Vol. 26 No. 12

(with which is merged the Aerologist)

DESIGN, INSTALLATION, OPERATION AND MAINTENANCE IN INDUSTRIAL, COMMERCIAL, INSTITUTIONAL AND PUBLIC BUILDINGS

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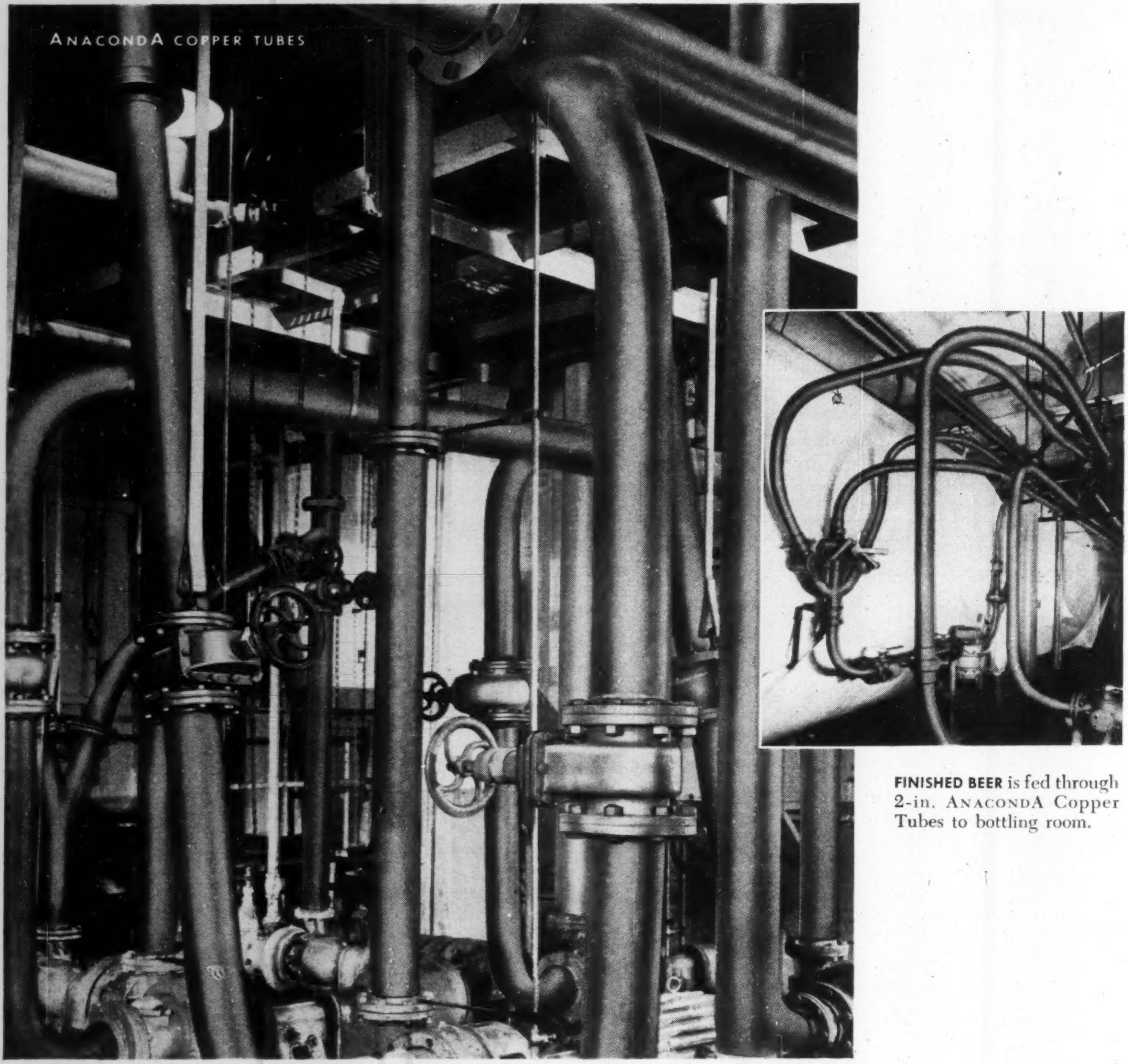

FINISHED BEER is fed through 2-in. ANACONDA Copper Tubes to bottling room.

PUMPING ROOM of Liebmann Breweries, Inc., Brooklyn, N. Y. Notice the smooth bends and braze into main line (at top of picture). These are the kinds of savings you get with ANACONDA Copper Tubes.

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Write for free booklet, "ANACONDA Copper Tubes for Industrial Applications" to *The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont.*

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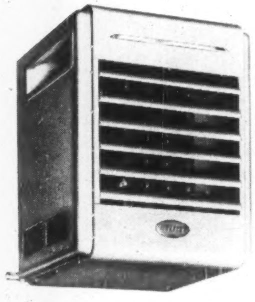

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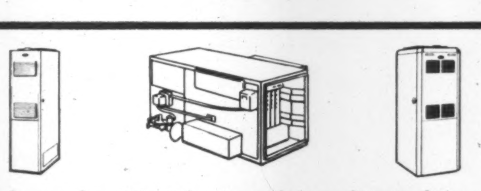

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Airview of SACRED HEART CATHEDRAL showing cruciform design.

SACRED HEART CATHEDRAL

NEWARK, N. J.
Formal Opening October 1954

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Mechanical Engineers:
SEARS and KOPF
ABRAHAM WALTON, New York
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Altar crucifix is life size carved from flesh colored onyx.

Traditional and modern religious buildings both require the greater comfort, fuel economy and dependable performance of

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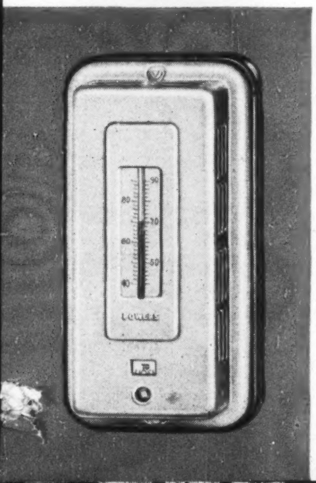

SACRED HEART CATHEDRAL in Newark, New Jersey — a masterpiece of French-Gothic architecture — is one of many distinguished churches and synagogues controlled by Powers.

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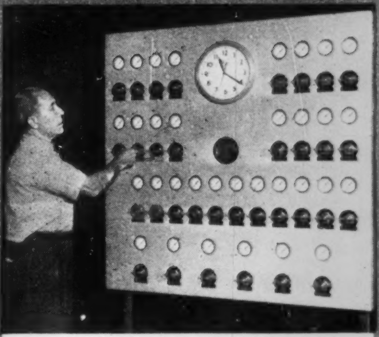
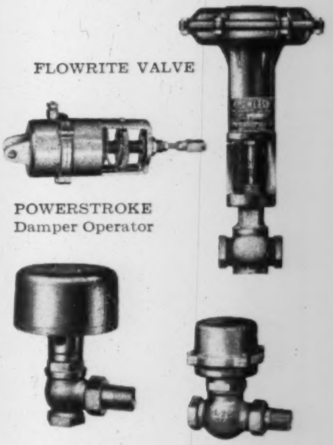


POWERS CONTROL PANEL



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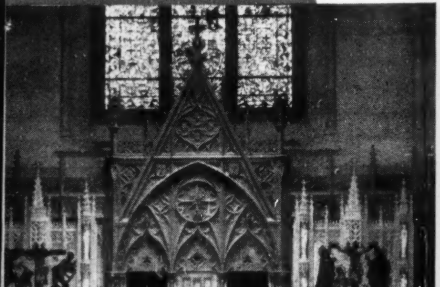
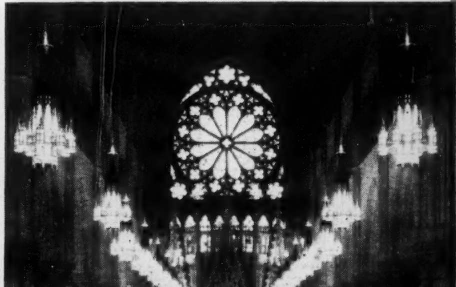


Confessionals of hand carved white oak flanked by mosaic stations of the cross.



View from altar looking toward rose window over main entrance.

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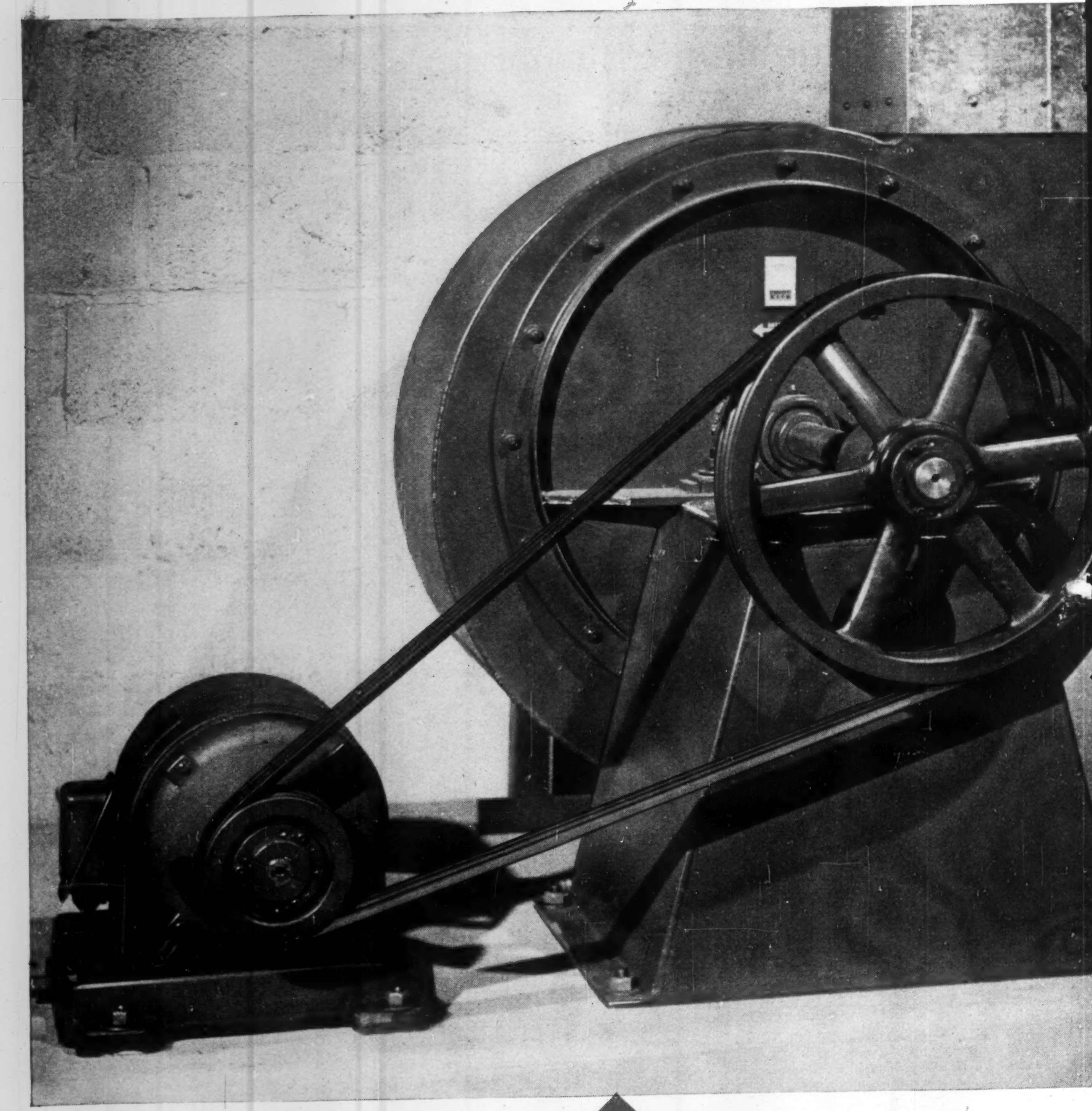

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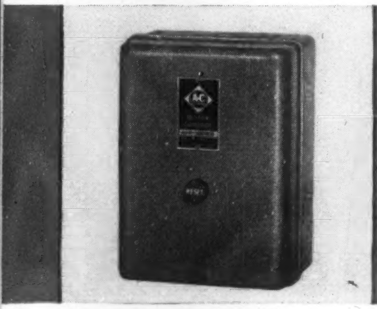

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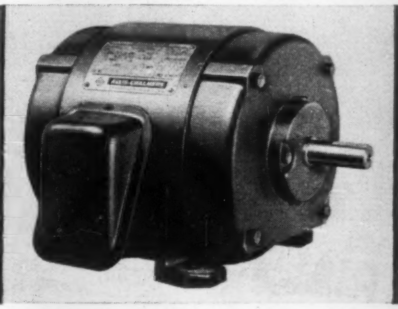
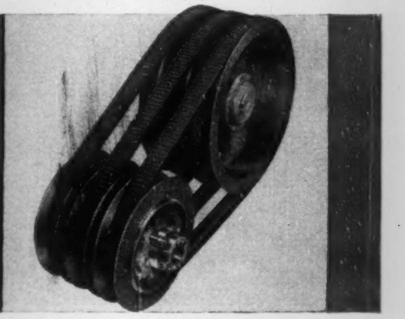


MOTOR



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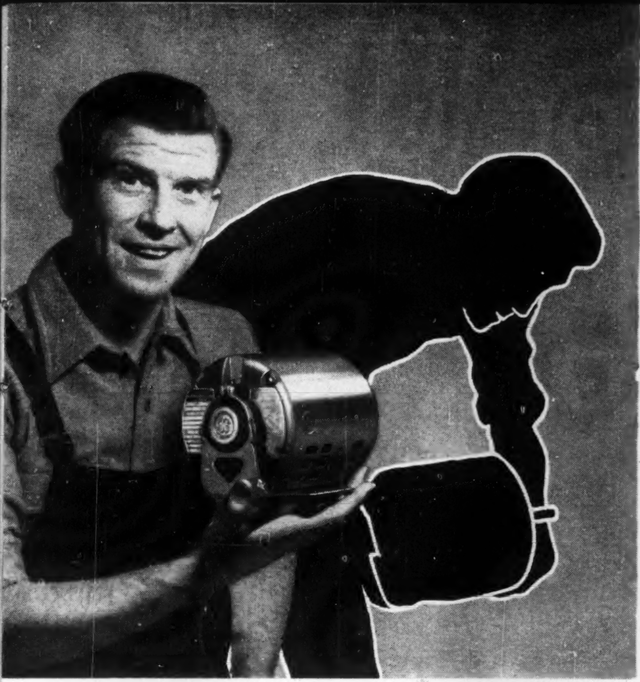

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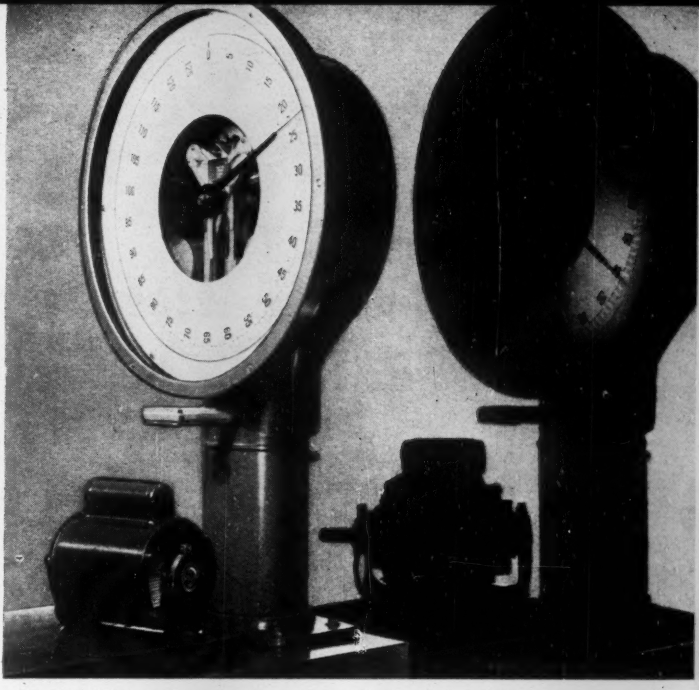


YOU SAVE ON TRANSPORTATION COSTS because G-E motors on your products weigh up to 50% less than other makes. Add in savings due to lighter mountings or housings.

New General Electric motors help you cut material costs, improve products

Smaller, lighter G-E fhp motors save on assembly and shipping, too!

YOU SAVE THREE WAYS when all-new General Electric fractional-hp motors power your products: (1) On materials—because these G-E motors are up to 40% smaller, they permit you to use smaller mountings and housings. (2) On assembly—up to 50% lighter, they reduce handling fatigue, help boost assembly-line efficiency. (3) On transportation and storage—they cost less to ship, require less warehouse space.

MORE COMPACT, ATTRACTIVE PRODUCTS are another benefit of these new G-E motors. When re-designing, you can take advantage of their smaller size and lighter weight to improve your own products, make them more compact and saleable.

MOTOR LIFE INCREASED, TOO! New G-E fhp motors give you longer life and greater dependability as well as more compact power. They feature new design techniques and modern materials which mean *greater* motor protection, *reduced* motor maintenance, and *wider* motor usability. For example:

- New G-E insulation system provides superior protection against moisture, aging, and deteriorants through use of Mylar* polyester film slot-insulation, Formex** wire, Glyptal** varnish and Neoprene leads.
- New G-E lubrication system doubles lubrication life . . . on some applications no relubrication required.
- Quiet, all-angle G-E sleeve bearings permit operation of motors in any position, eliminate the need for many costly specials.

TO START SAVING with these popular new motors, contact your nearby G-E Apparatus Sales Office today. Or write for Bulletin GEA-5567 to General Electric Company, Section 702-11, Schenectady 5, New York.

*Dupont Trade-mark
**Reg. Trade-mark of General Electric Company

Progress Is Our Most Important Product

GENERAL ELECTRIC

Give your clients better indoor weather

Why Honeywell Customized Temperature Control is a "must" in modern buildings

In every line of business how well your clients do eventually gets down to one thing—how well do they please people?

This includes customers and employees.

And it's valid whether they deal in products or services.

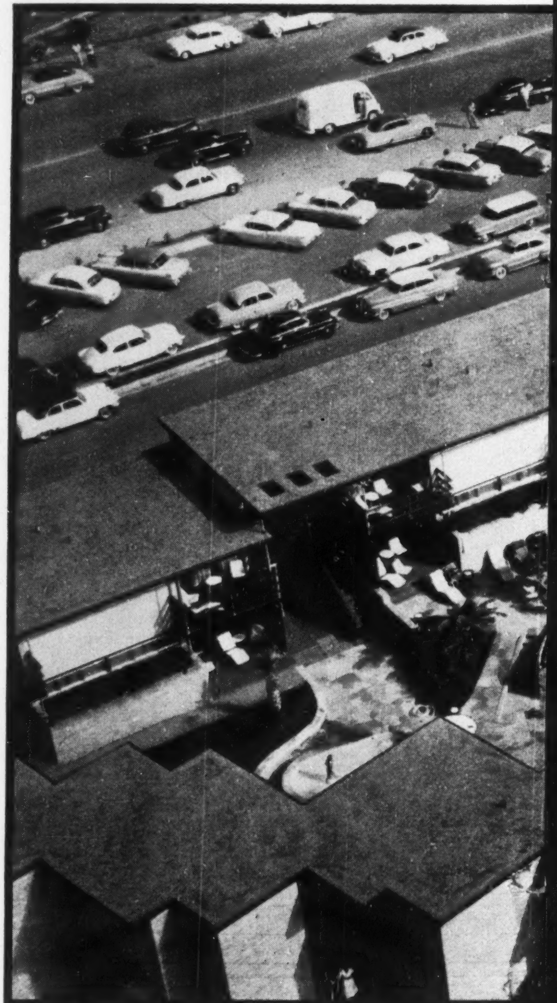
In the hotel business comfort is sold—and to a different set of customers every night.

This is the big reason why the hotel you see here (the Jack Tar Hotel in Galveston) features Honeywell Customized Temperature Control. Each unit has its own set of Honeywell *electronic* controls to give customers better Indoor Weather. Comfort is provided by chilled water for cooling, hot water for heating—and dehumidification during the muggy summer months.

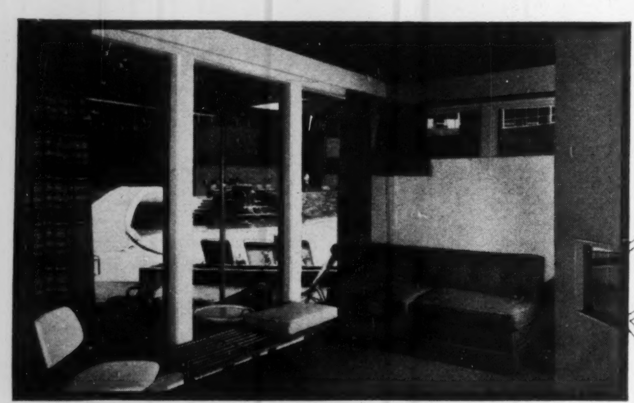
The *techniques* used, applied to your particular problems, can help you give your clients the Indoor Weather they've always wanted—customized to their requirements.

The key word here is "customized." It means that whatever your clients' control requirements, a Honeywell Customized Temperature Control installation *designed to fit the needs of the building and its occupants* is your answer. This applies not only to heating and cooling, ventilating and humidity control, but to industrial control as well.

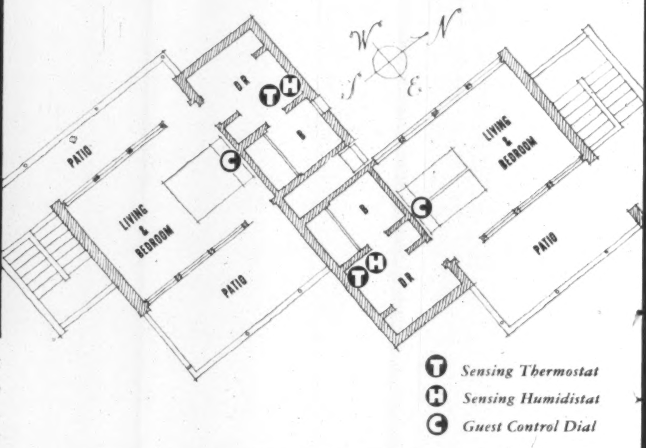
Only Honeywell can provide true "customized" control. Because only Honeywell manufactures all three types of controls—pneumatic, electric and electronic.



Electronic controls are important to comfort in the Jack Tar Hotel in Galveston, Texas. Humid air from the Gulf of Mexico across the highway—and heat from the Texas sun—demand the rapid response provided only by electronic controls. Architect: Thomas M. Price; Consulting Engineers: Olin Rivoire, Joseph A. Poole; Mechanical Contractor: Way Engineering Co.



Individual comfort is insured by an *electronic* control panel built into the bed headboard of each unit. Customers simply turn a knob for more or less heating or cooling—and the system does the rest. With Honeywell Customized Temperature Control on the job, they get the *exact* degree of comfort they want.



TYPICAL 2nd FLOOR UNITS

For comfortable, even temperature in new or existing buildings—of any size—specify Honeywell Customized Temperature Control

Whether it's a hotel, hospital, factory—any building of any size—new or existing, Honeywell Customized Temperature Control can help meet your clients' heating, ventilating, air conditioning and industrial control problems. You can give your clients more comfort and efficiency, and they'll save fuel, too.

For full facts on Honeywell Customized Temperature Control, call your local Honeywell office. Or mail the coupon today.

Pioneers in Electronic Control

MINNEAPOLIS
Honeywell

112 OFFICES
ACROSS THE NATION

H
HONEYWELL

First in Controls

Ed. C. Leach, president and managing director, Jack Tar Hotels, says:

"We used a Honeywell Electronic control system because it allows for personalized temperature selection. And because, like everything else about the Jack Tar Hotel, it's modern in every detail."

MINNEAPOLIS-HONEYWELL REGULATOR CO.
Dept. HA-12-225, Minneapolis 8, Minnesota
Gentlemen:

I'm interested in learning more about Honeywell Customized Temperature Control.

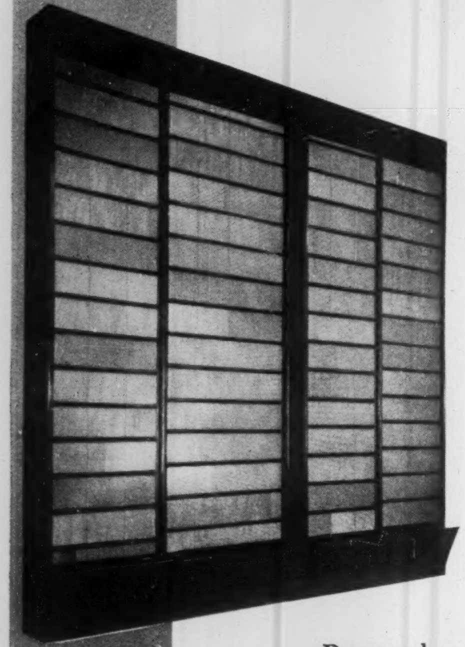
*Name*____________________

*Firm Name*____________________

*Address*____________________

*City*__________ *Zone*____ *State*________

FOR A LIFETIME OF SERVICE WITH A MINIMUM OF ATTENTION...



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Self Cleaning
AUTOMATIC
AIR FILTERS

Patented media design and positive flushing action of Continental's advanced engineering assure high efficiency, freedom from clogging, and dependable, trouble-free self-cleaning—month after month, year in, year out. For an absolute minimum of maintenance time and cost, specify Continental... top performer among high-velocity, viscous-impingement automatic self-cleaning air-filters.

Ask for the new Continental Automatic Air Filter catalog—Bulletin 202. Get it from the Continental sales representative in your city—or write us at the home office. No charge or obligation.

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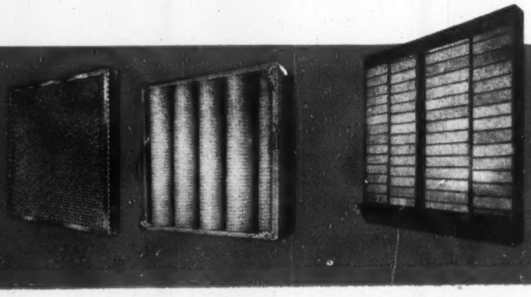
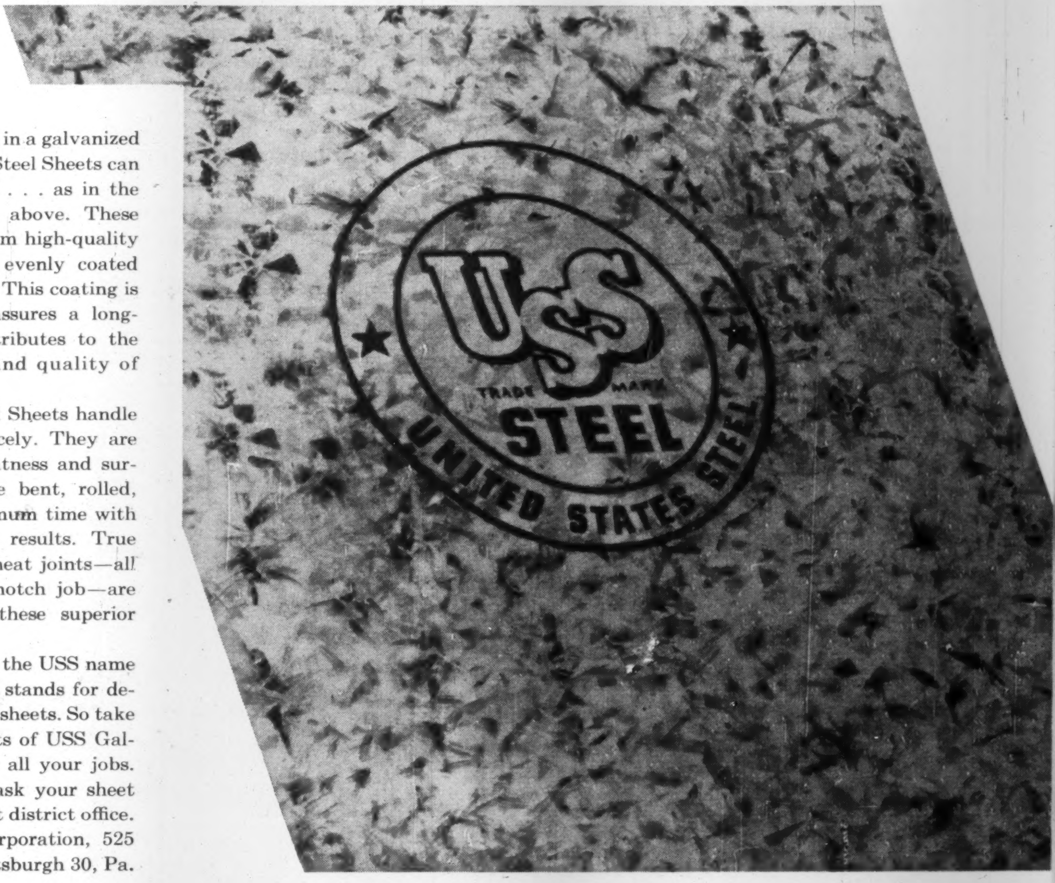
LOUISVILLE 1, KY.

CONTINENTAL
AIR FILTERS Inc.



USS Galvanized Steel Sheets

assure corrosion resistance



For corrosion resistance in a galvanized sheet, USS Galvanized Steel Sheets can be used with assurance . . . as in the roof ventilators shown above. These fine sheets are rolled from high-quality carbon steel and then evenly coated with rust-resistant zinc. This coating is tightly adherent and assures a long-lasting finish that contributes to the pleasing appearance and quality of every job you turn out.

USS Galvanized Steel Sheets handle easily, and work up nicely. They are uniform in ductility, flatness and surface finish; and can be bent, rolled, stamped or cut in minimum time with completely satisfactory results. True bends, tight seams and neat joints—all characteristic of a top-notch job—are quick and easy with these superior sheets.

Your customers know the USS name—they recognize that it stands for dependable quality in steel sheets. So take advantage of the benefits of USS Galvanized Steel Sheets for all your jobs. For more information, ask your sheet distributor or our nearest district office. United States Steel Corporation, 525 William Penn Place, Pittsburgh 30, Pa.

UNITED STATES STEEL CORPORATION, PITTSBURGH · COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO
TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA. · UNITED STATES STEEL SUPPLY DIVISION, WAREHOUSE DISTRIBUTORS, COAST-TO-COAST
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

USS GALVANIZED STEEL SHEETS

4-1697

UNITED STATES STEEL

JENKINS PRACTICAL PIPING LAYOUTS

68

How to plan a

HIGH PRESSURE — HIGH TEMPERATURE HOT WATER PIPING SYSTEM

For many applications, a high pressure—high temperature system, like the one illustrated here, offers several distinct advantages over a steam system. It provides for efficient space heating and water heating, and also for numerous processing needs, such as dye vats, plating tanks and evaporators.

Often operated at pressures up to 215 psi, with a corresponding temperature of 388°F, a HP-HT system of this type employs a simpler piping design that eliminates the need for pitch, drainage, or traps. It provides a far greater amount of heat transmission for a given pipe size and, since makeup is extremely low, requires no feed-water treatment. Also, when this system is used for processing services, there are no large pressure drops due to sudden load conditions.

The hot water is generated in a shell and tube heat exchanger by means of high pressure steam from either turbine extraction or turbine exhaust. A closed expansion tank maintains constant pressure within the system. Water is circulated by regular closed expansion tank maintains constant pressure boiler feed type centrifugal pumps to all uses. A high pressure makeup pump delivers the small amount of makeup required. As shown in the diagram a recording and integrating Btu meter indicates thermal energy consumed by equipment.

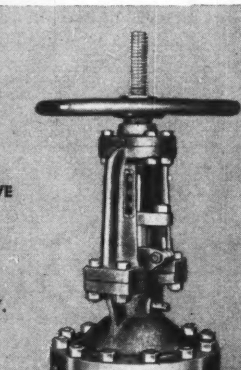
Unit heaters on the HP-HT lines provide for space heating requirements. A shell and tube heat exchanger supplies warm water for lavatories, kitchens, and processing which requires moderate temperatures.

When accumulators are used another important advantage of this system is the storage of steam in excess of the HP-HT demand. This feature is particularly desirable when the load on the turbine from which the steam is extracted or exhausted is not in coincidence with the system's demand. Under these circumstances, steam may be drawn from the accumulators to meet the increased HP-HT requirements. Thus, the need for taking additional steam directly from the steam generating source is decreased or eliminated, with a better plant heat balance as a direct result.

Jenkins Fig. 1010-CM Cast Steel Gate Valves are recommended for the thermostatic steam admission valve shutoffs in this system. For 300 lb. service, at temperatures to 850°F, they are made of carbon molybdenum alloy steel, with stainless steel wedges (up to 8″ size) and H-monel seat rings. The rising spindle serves to indicate the position of the wedge. Operating threads are on the outside, allowing easy cleaning and lubrication.

Consultation with accredited piping engineers and contractors is recommended when planning any major piping installation.

To save time, to simplify planning, to get all the advantages of Jenkins specialized valve engineering experience, select all the valves you need from the complete Jenkins line. It's your best assurance of *lowest cost in the long run.* Jenkins Bros., 100 Park Ave., New York 17. Sold through Leading Industrial Distributors everywhere.



Rising Spindle
CAST STEEL GATE VALVE
300 lb.
Steam or Water
To 850°F
Fig. 1010-CM
Solid Wedge — O. S. & Y.

Jenkins
cast steel
Valves

The *extra* measure of efficiency and endurance built into *all* Jenkins Valves is a distinguishing feature of Jenkins Cast Steel Valves. Compare the quality, and see why it pays to specify *Jenkins.* A new catalog of Cast Steel Valves gives detailed pressure ratings, dimensions, and other technical data covering all patterns. Send for your copy.

Jenkins Bros., 100 Park Avenue
New York 17, N. Y.
Please send folder Cast Steel Valves

Name..

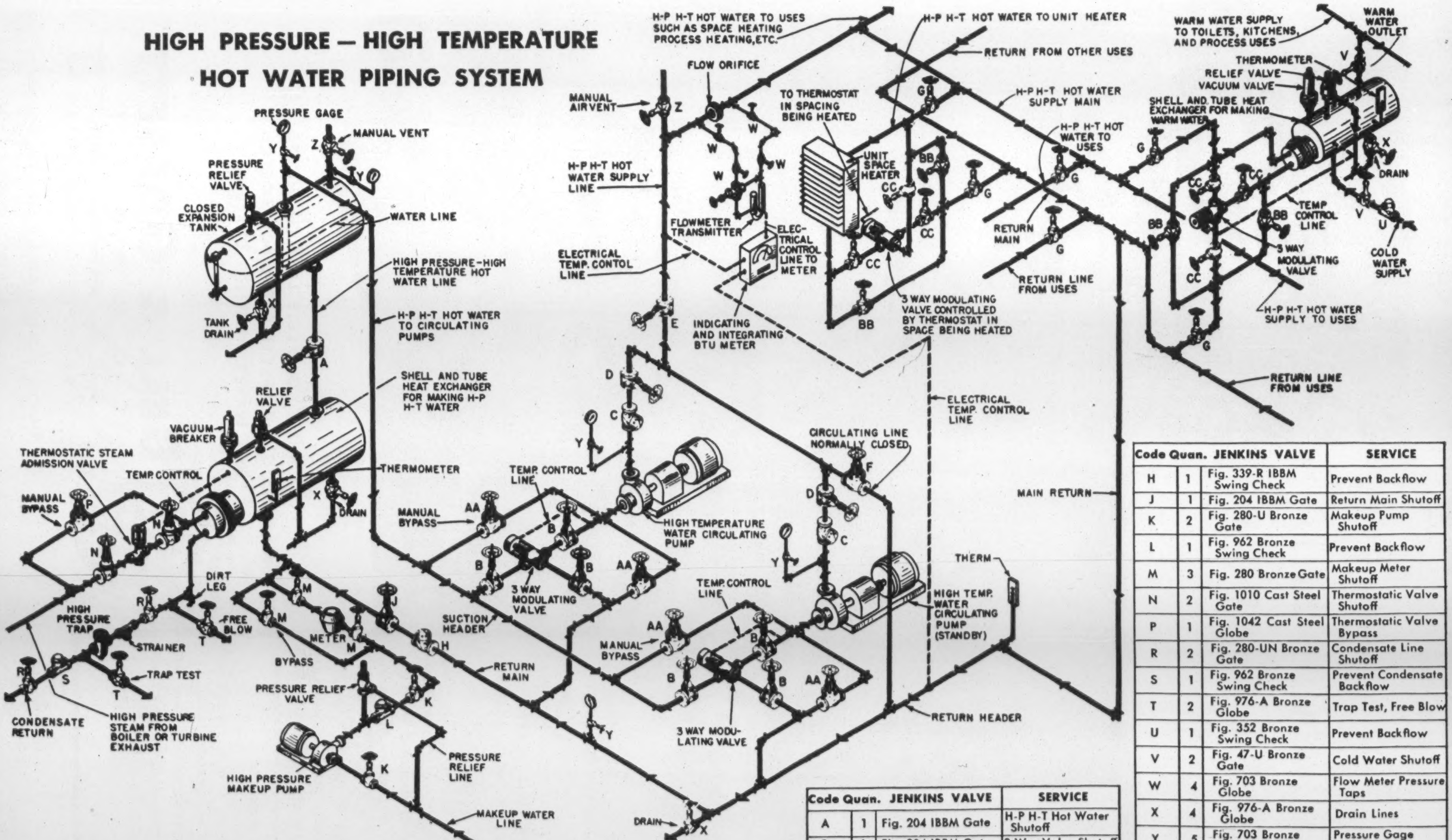
Company..

Address..

JENKINS
LOOK FOR THE DIAMOND MARK
VALVES
SINCE 1864
TRADE JENKINS MARK

Jenkins Bros

HIGH PRESSURE — HIGH TEMPERATURE
HOT WATER PIPING SYSTEM


PRESSURE GAGE
MANUAL VENT
PRESSURE RELIEF VALVE
CLOSED EXPANSION TANK
WATER LINE
HIGH PRESSURE-HIGH TEMPERATURE HOT WATER LINE
H-P H-T HOT WATER TO CIRCULATING PUMPS
TANK DRAIN
SHELL AND TUBE HEAT EXCHANGER FOR MAKING H-P H-T WATER
RELIEF VALVE
VACUUM BREAKER
THERMOSTATIC STEAM ADMISSION VALVE
TEMP. CONTROL
MANUAL BYPASS
THERMOMETER
DRAIN
DIRT LEG
HIGH PRESSURE TRAP
FREE BLOW
STRAINER
TRAP TEST
CONDENSATE RETURN
HIGH PRESSURE STEAM FROM BOILER OR TURBINE EXHAUST
METER
BYPASS
SUCTION HEADER
RETURN MAIN
PRESSURE RELIEF VALVE
HIGH PRESSURE MAKEUP PUMP
PRESSURE RELIEF LINE
MAKEUP WATER LINE
MANUAL BYPASS
TEMP. CONTROL LINE
3 WAY MODULATING VALVE
HIGH TEMPERATURE WATER CIRCULATING PUMP
MANUAL AIRVENT
H-P H-T HOT WATER SUPPLY LINE
ELECTRICAL TEMP. CONTOL LINE
H-P H-T HOT WATER TO USES SUCH AS SPACE HEATING PROCESS HEATING, ETC.
FLOW ORIFICE
FLOWMETER TRANSMITTER
ELECTRICAL CONTROL LINE TO METER
INDICATING AND INTEGRATING BTU METER
TO THERMOSTAT IN SPACING BEING HEATED
UNIT SPACE HEATER
3 WAY MODULATING VALVE CONTROLLED BY THERMOSTAT IN SPACE BEING HEATED
H-P H-T HOT WATER TO UNIT HEATER
RETURN FROM OTHER USES
H-P H-T HOT WATER SUPPLY MAIN
H-P H-T HOT WATER TO USES
RETURN MAIN
RETURN LINE FROM USES
ELECTRICAL TEMP. CONTROL LINE
CIRCULATING LINE NORMALLY CLOSED
MAIN RETURN
THERM
HIGH TEMP. WATER CIRCULATING PUMP (STANDBY)
TEMP. CONTROL LINE
MANUAL BYPASS
3 WAY MODULATING VALVE
RETURN HEADER
DRAIN
WARM WATER SUPPLY TO TOILETS, KITCHENS, AND PROCESS USES
WARM WATER OUTLET
THERMOMETER
RELIEF VALVE
VACUUM VALVE
SHELL AND TUBE HEAT EXCHANGER FOR MAKING WARM WATER
DRAIN
TEMP CONTROL LINE
3 WAY MODULATING VALVE
COLD WATER SUPPLY
H-P H-T HOT WATER SUPPLY TO USES
RETURN LINE FROM USES
A
B
C
D
E
F
G
H
J
K
L
M
N
P
R
S
T
U
V
W
X
Y
Z
AA
BB
CC

Code	Quan.	JENKINS VALVE	SERVICE
A	1	Fig. 204 IBBM Gate	H-P H-T Hot Water Shutoff
B	6	Fig. 204 IBBM Gate	3 Way Valve Shutoff
C	2	Fig. 339-R IBBM Swing Check	Prevent Backflow
D	2	Fig. 204 IBBM Gate	Pump Discharge Shutoff
E	1	Fig. 204 IBBM Gate	Supply Line Shutoff
F	1	Fig. 923 IBBM Globe	Circulating Line Shutoff
G	6	Fig. 280 Bronze Gate	Branch Shutoffs

Code	Quan.	JENKINS VALVE	SERVICE
H	1	Fig. 339-R IBBM Swing Check	Prevent Backflow
J	1	Fig. 204 IBBM Gate	Return Main Shutoff
K	2	Fig. 280-U Bronze Gate	Makeup Pump Shutoff
L	1	Fig. 962 Bronze Swing Check	Prevent Backflow
M	3	Fig. 280 Bronze Gate	Makeup Meter Shutoff
N	2	Fig. 1010 Cast Steel Gate	Thermostatic Valve Shutoff
P	1	Fig. 1042 Cast Steel Globe	Thermostatic Valve Bypass
R	2	Fig. 280-UN Bronze Gate	Condensate Line Shutoff
S	1	Fig. 962 Bronze Swing Check	Prevent Condensate Backflow
T	2	Fig. 976-A Bronze Globe	Trap Test, Free Blow
U	1	Fig. 352 Bronze Swing Check	Prevent Backflow
V	2	Fig. 47-U Bronze Gate	Cold Water Shutoff
W	4	Fig. 703 Bronze Globe	Flow Meter Pressure Taps
X	4	Fig. 976-A Bronze Globe	Drain Lines
Y	5	Fig. 703 Bronze Globe	Pressure Gage Control
Z	2	Fig. 976-A Bronze Globe	Air Vents
AA	4	Fig. 923 IBBM Globe	3 Way Valve Bypass
BB	4	Fig. 976-A Bronze Globe	3 Way Valve Bypass
CC	6	Fig. 280 Bronze Gate	3 Way Valve Shutoff

Diagram by Huxley Madeheim, Consulting Engineer

For details of valves to suit varying conditions, see Jenkins Catalog.

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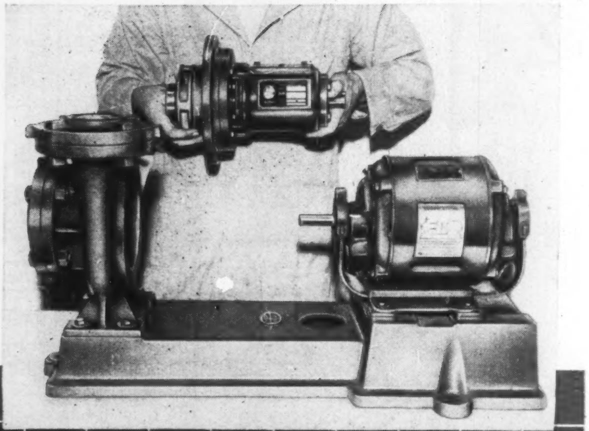
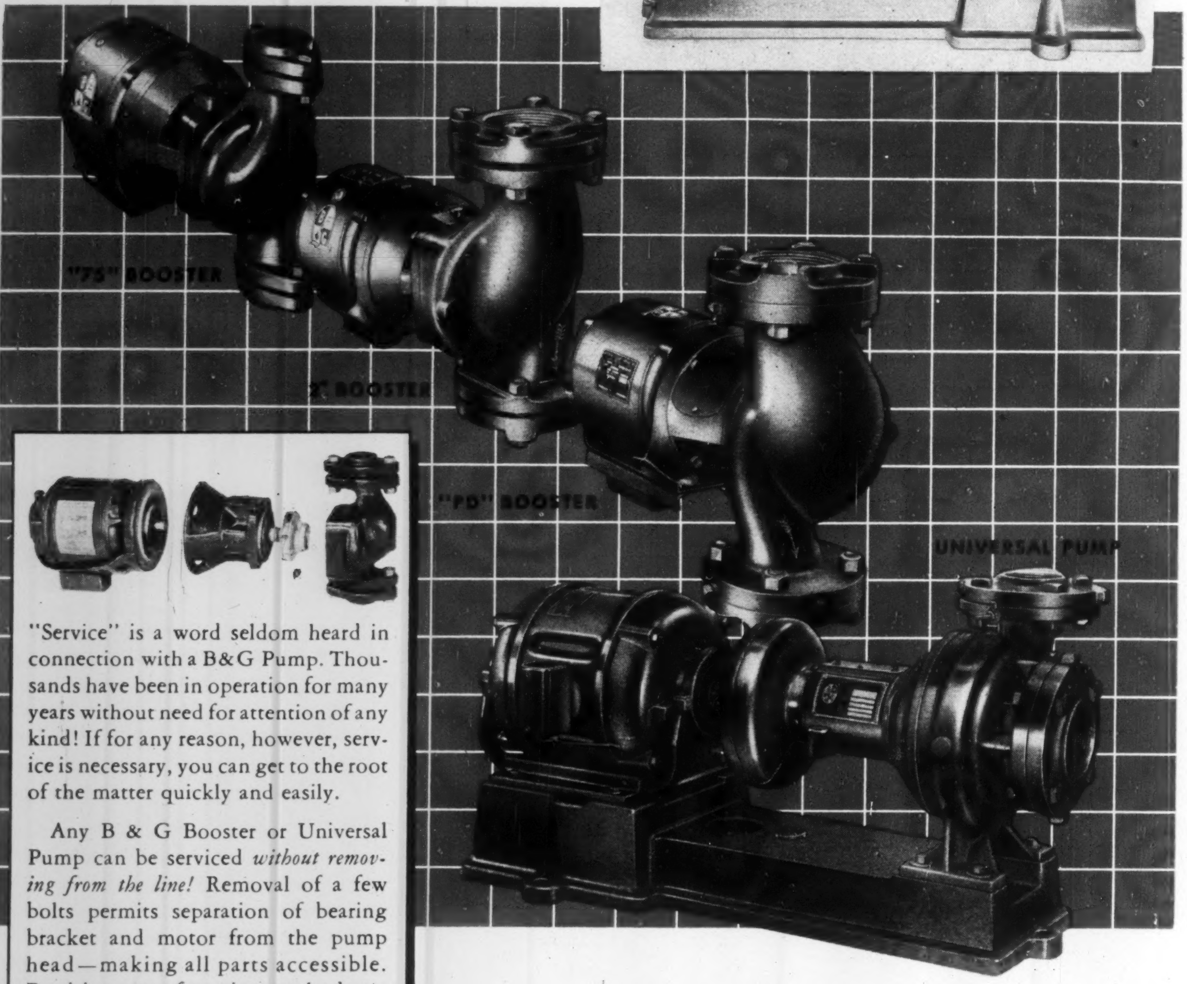
B&G PUMPS ARE *EASIER TO SERVICE*

(BUT SELDOM NEED IT)





"Service" is a word seldom heard in connection with a B&G Pump. Thousands have been in operation for many years without need for attention of any kind! If for any reason, however, service is necessary, you can get to the root of the matter quickly and easily.

Any B & G Booster or Universal Pump can be serviced *without removing from the line!* Removal of a few bolts permits separation of bearing bracket and motor from the pump head—making all parts accessible. Precision manufacturing methods assure positive accuracy of fit and complete interchange of parts between pumps of the same size.

In every detail, B & G Pumps are constructed to (1) operate *quietly*, (2) perform *dependably* and (3) last for *years!* That's why more are sold than any other pump built for the same purpose.

THE MOST COMPLETE LINE OF PUMPS DESIGNED SPECIFICALLY FOR FORCED HOT WATER HEATING SYSTEMS

B & G

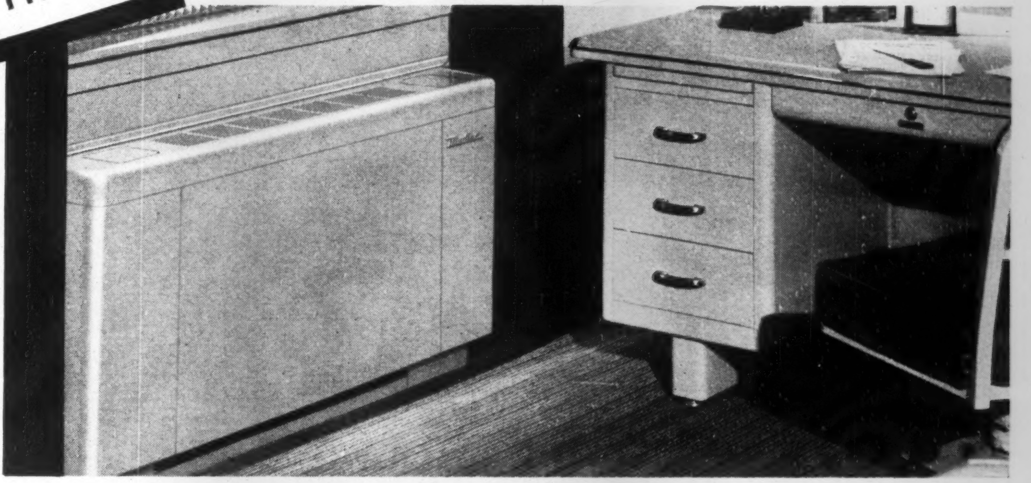
BELL & GOSSETT
COMPANY
Dept. DR-5 Morton Grove, Illinois
Canadian Licensee: S. A. Armstrong, Ltd., 1400 O'Connor Drive, Toronto, Canada

NOW — *for low-cost, year 'round air conditioning of individual rooms*

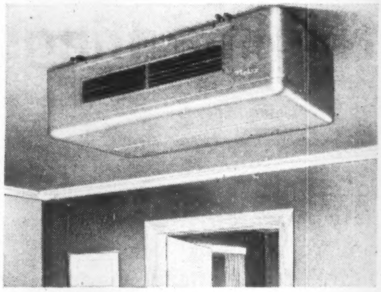
YOUR CHOICE OF 4 TYPES OF THE NEW

Modine AIRditioner

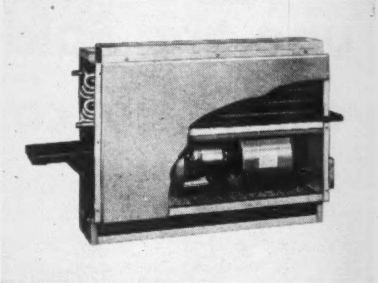
IT COOLS
IT HEATS
IT VENTILATES



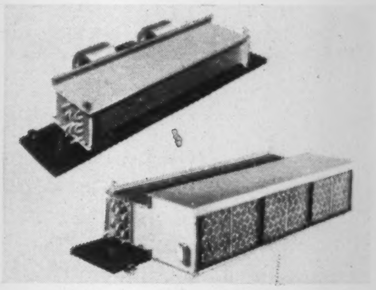
CONSOLE MODEL—superbly styled and finished—blends gracefully with any interior decor. Design facilitates recessing—only 6 in. need project into room. Also for free-standing installation.



CEILING MODEL — deluxe unit for exposed installation on ceiling—saves floor space.



CONCEALED MODEL (front panel cutaway) permits out-of-sight installation in wall.



OVERHEAD MODELS — with or without plenum and filter for use in furred space.

HERE'S low-cost cooling, heating, ventilating, filtering, dehumidifying and circulating of air for individual rooms. Ideal for hotels, offices, apartments, motels, hospitals and similar multi-room applications. AIRditioners* save cost of installing central duct systems in new buildings. On modernization jobs, they solve the difficult problem of providing supply and return ducts in existing walls.

Cold water from a central chiller or other source is piped to each unit for summer cooling. Heating is accomplished with hot water from a central heating plant. *The same piping* —water supply and return, and drain —serves each unit for both cooling and heating. And AIRditioners are *individually controllable.*

Get all the facts on the new AIRditioner from the Modine representative listed in your classified phone book. Or clip this coupon and mail it today.

**Trademark*

Modine AIRditioner

MODINE MFG. CO.
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Please send me a free copy of Bulletin describing "The New Modine AIRditioner."

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City .... Zn ...... State ....

A-1249

NO THREADS!

Chase Copper Tube and Solder-Joint Fittings

save time, cut costs!

When you install a drainage system, why wrestle with heavy tools or take the time to thread pipes or wipe joints? Use Chase Copper Tube and Solder-Joint Fittings!

Chase Copper Tube comes in long, 20 foot lengths—requires fewer joints. It's light but rugged—permits a considerable amount of economical pre-assembly.

With Chase Solder-Joint Fittings you can install a completely *pressure-tight* drainage system, using standard soldering techniques. What's more, you save time in installation—and in final pressure-testing as well.

Chase Copper Tube and Chase Solder-Joint Fittings make *your* job easier. Your Chase Wholesaler has both—contact him today.

Chase®
BRASS & COPPER CO.

Chase® Products mean
a quality job at little
or no extra cost!

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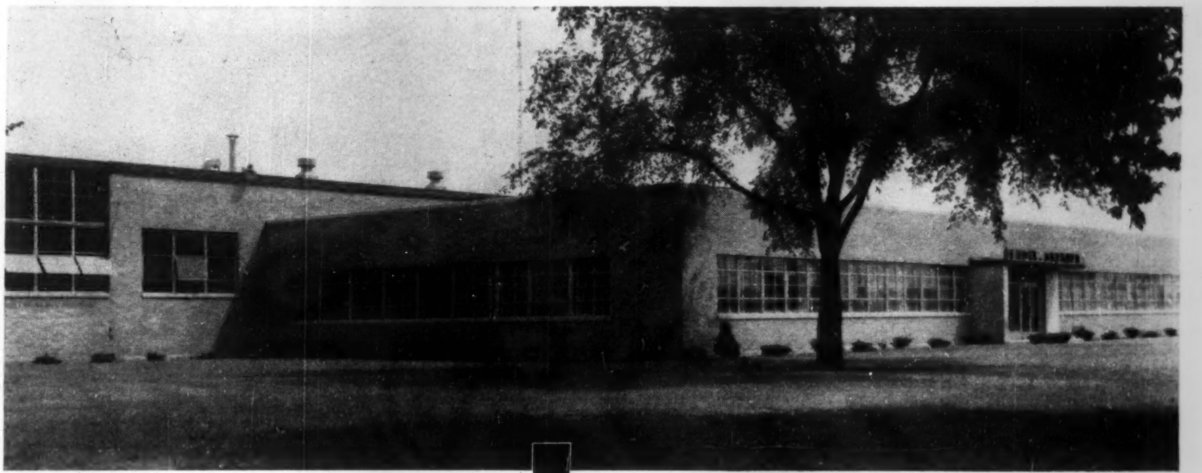
How a company planned ahead for economy in boiler operation and "reserve" for future expansion . . .

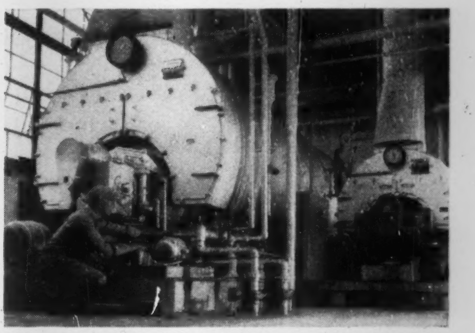


Bendix-Skinner Division, Bendix Aviation Corp., Royal Oak, Mich.
Architects & Engineers—Giffels and Vallet, Inc. . . L. Rossetti—Detroit, Mich.
Heating Contractor—The Donald Miller Co., Detroit, Mich.

KEWANEE reserve + plus rating

. . . formed the basis for boiler selection at Bendix-Skinner Division, Bendix Aviation Corporation

With an eye on the present and to the future, Bendix-Skinner executives selected Kewanee Boilers for their Royal Oak, Michigan plant. The problem of the present was to select boilers capable of supplying sufficient power for both heating and processing at lowest operating and maintenance cost. Past experience convinced Bendix-Skinner executives Kewanee could be depended upon for savings and satisfactory performance under all conditions. The problem of the future was providing boilers with sufficient built-in reserve to accommodate increased loads when plant expansion came. Here Kewanee was first choice again because Kewanee Reserve Plus Rating certifies 50% extra power is built in for pick-up and additional capacity requirements. It means "cruising speed" operation, with the boiler *loafing* along at a *leisurely* rate, using less fuel . . . delivering greater efficiency. That's because Kewanee Reserve Plus assures a boiler that's rated on nominal capacity with sufficient reserve to take care of emergencies—fluctuating loads—expansion. Bendix-Skinner executives knew the fallacy of boilers rated on maximum capacity which must run at full speed constantly, so, naturally their choice was Kewanee.



Here are 2 Kewanee Reserve Plus Rated Boilers installed at Bendix-Skinner. At left, 88-100 Kewanee Boiler-Burner Unit—100 GPH. At right, 78-25 Boiler-Burner Unit—25 GPH.

KEWANEE BOILERS

KEWANEE-ROSS CORPORATION, Kewanee, Illinois
Division of American Radiator & Standard Sanitary Corporation

Serving home and industry · American-Standard · American Blower · Church Seats & Wall Tile · Detroit Controls · Kewanee Boilers · Ross Exchangers · Sunbeam Air Conditioners

YOU can depend on KEWANEE engineering

announcing the all-new UNARCO® dual-vector*

for winter heating...for summer cooling

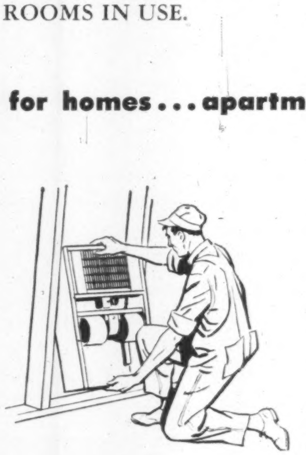
a new product . . . at a new low price

Of interest to dealers, jobbers and contractors is the new Unarco DUAL-VECTOR . . . the first quality product of its kind *priced to compete with any conditioning system.* The DUAL-VECTOR at last makes feasible the combination of a fine hot water heating and chilled water cooling system. DUAL-VECTORS are available for immediate delivery.

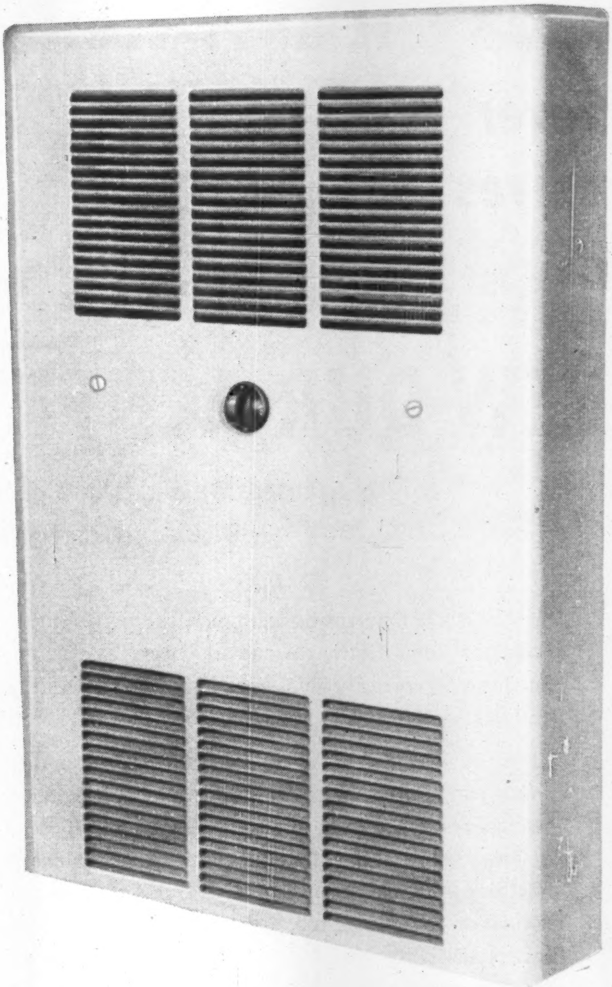
DUAL-VECTORS are used in a series, one-pipe or two-pipe system, providing forced hot water heat in winter and chilled water cooling in warm weather. Built-in individual room control—thermostatic or manual—assures low-cost operation, since the DUAL-VECTOR allows you to cool or heat ONLY THE ROOMS IN USE.

the UNARCO dual-vector is ideal for homes . . . apartments . . . hotels . . . motels

The DUAL-VECTOR is installed easily and quickly, being fastened between the studding at any desired height. Its quiet efficiency and individual room control make it especially appealing to the economy-minded. DUAL-VECTORS occupy a minimum of wall space, allowing easy cleaning of floors as well as the use of wall-to-wall carpeting.



*TRADE-MARK



Cover Dimensions:
25″ high; 16½″ wide; 3″ deep

Recessed Wall-Box Dimensions:
$23\frac{9}{16}$″ high; 14⅛″ wide; 3⅝″ deep

the new dual-vector offers...

All the advantages of a hot water heating system plus the universally desired comfort of balanced air conditioning.

Individual room temperature and humidity control.

Clean, quiet and even heat in the winter, and cooler months of the year.

Cool, dehumidified air in summer.

Twin fans assure positive delivery of freely circulating and filtered air throughout the year.

A flexible system adaptable to any size room.

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what the dual-vector means to you!

The DUAL-VECTOR enables you to sell a *better* system at less cost. It increases your market ten times over. NOW you can install air cooling together with hot water heat IN ONE ECONOMICAL PACKAGE!

It means better utilization of space, more flexibility in construction and reduced labor cost. These advantages are indicated by the ease and speed of installation of the DUAL-VECTOR—by the small-diameter piping required in contrast to bulky duct work—and by the small amount of space required for the heating and cooling unit.

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Dur-Ace is a new corrosion-resistant, rigid plastic pipe with exceptional impact strength and toughness . . . good for handling most corrosive fluids in your plant at moderate temperatures and pressures . . . with low first cost and long life.

Light in weight, Dur-Ace is odorless, tasteless, and non-contaminating. It maintains good strength, rigidity and chemical resistance from minus 40 deg. F. to 170 deg. F. As shown below, it handles all types of chemicals except a few strong acids and organic solvents. Dur-Ace is corrosion-resistant on the *outside* too, and saves the cost of painting. Electrolytic corrosion and bacteria have no effect on Dur-Ace, so it's excellent for underground lines handling water, brine, petroleum, natural gas, etc.

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Dur-Ace *is the* eighth *basic type of corrosion-resistant pipe available from ACE . . . including materials for high pressures, high temperatures, strong acids, organic solvents, etc., and pipe sizes to 24" and above. Consult ACE first with any corrosion problem.*

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- Most Plating Sols.
- Oil (SAE 10-30)

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- Hydrofluoric Acid 10%
- Nitric Acid 10%
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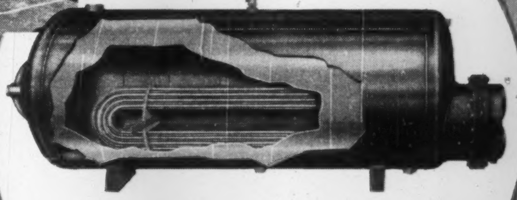

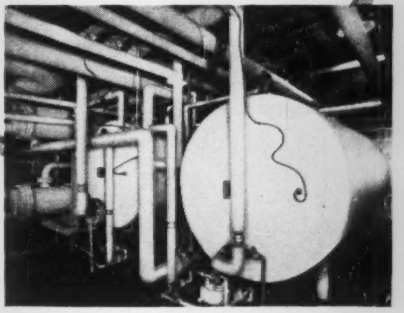

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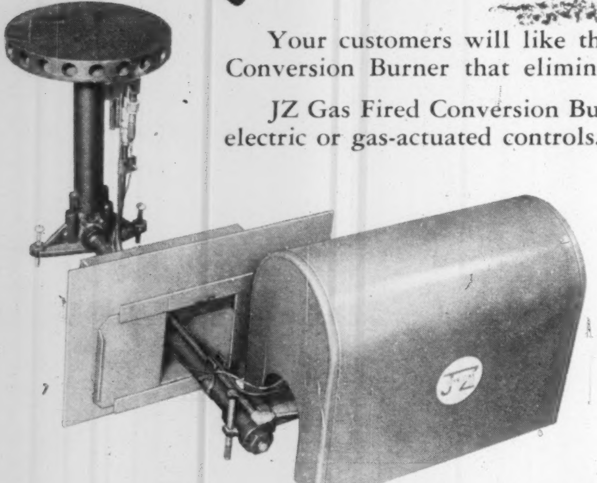

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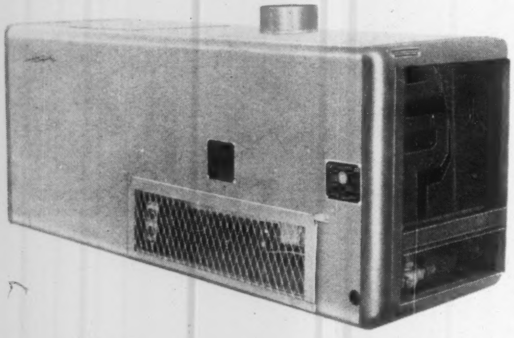

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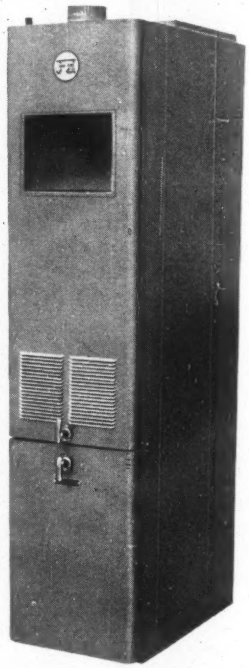

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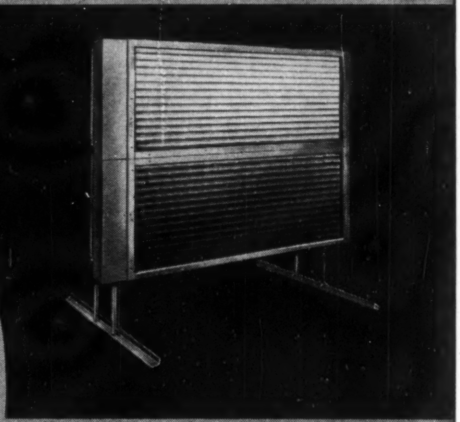

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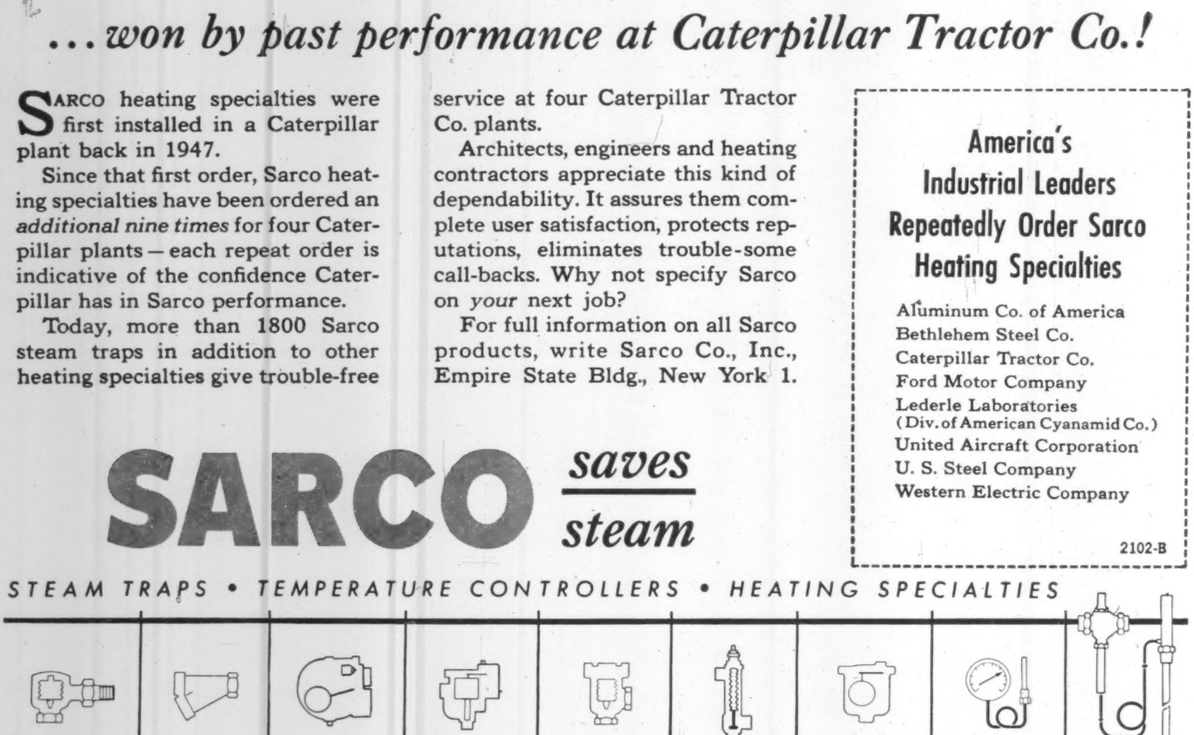
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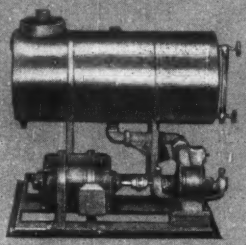

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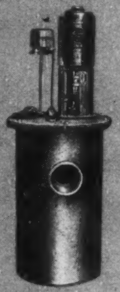

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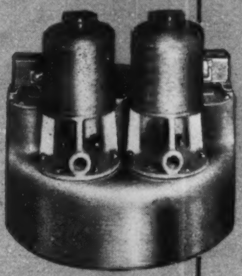

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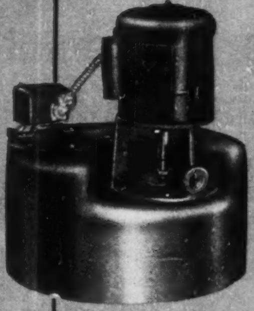
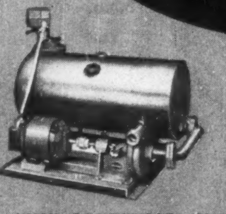


"CV" VERTICAL PUMP
Capacities ranging from 500 to 10,000 sq. ft. EDR and pressures from 10 to 20 lbs.



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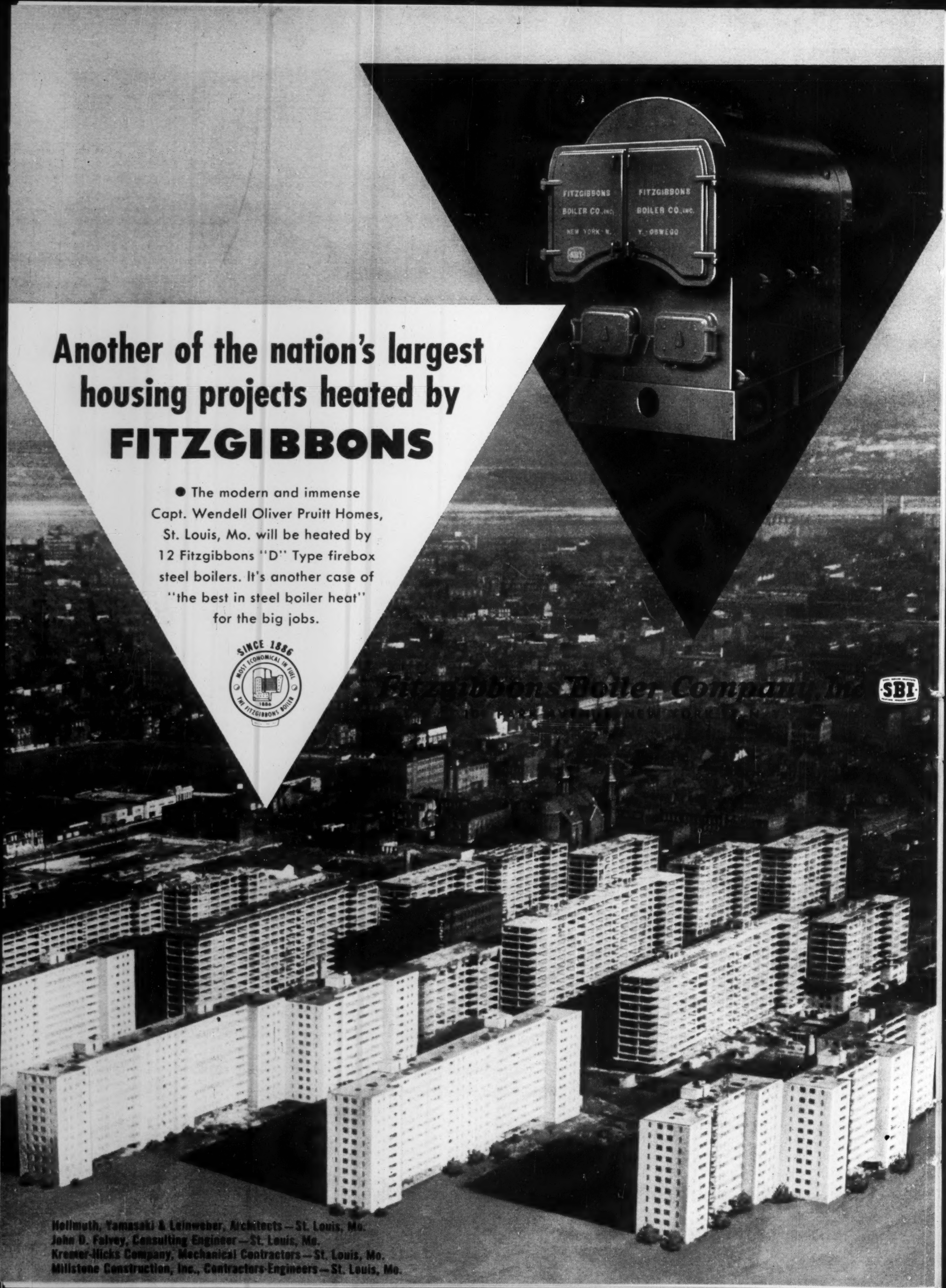
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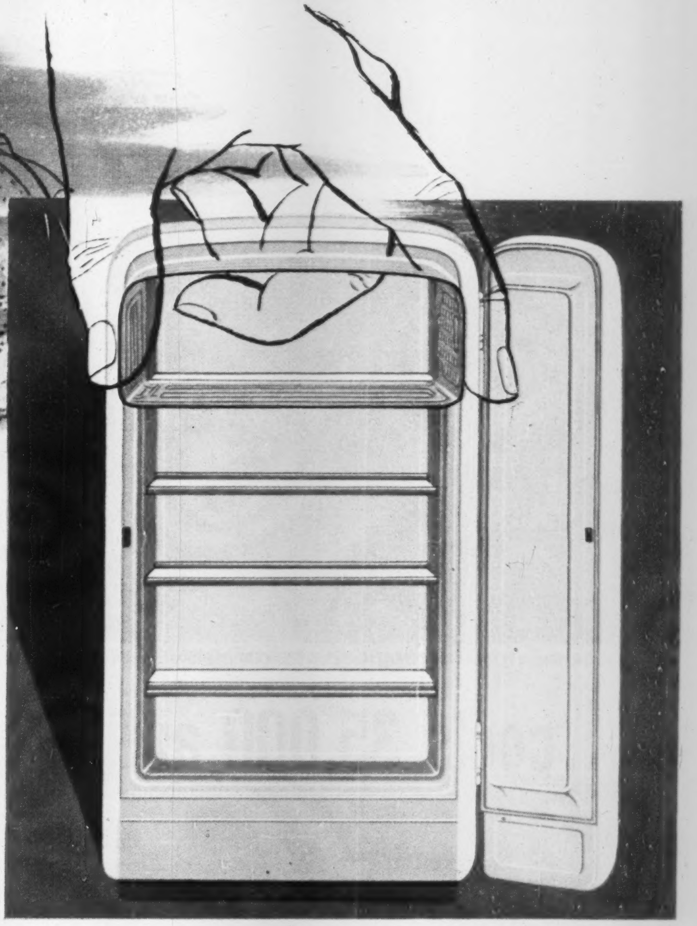

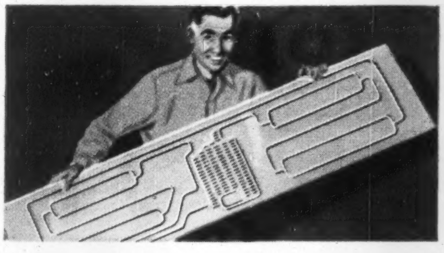

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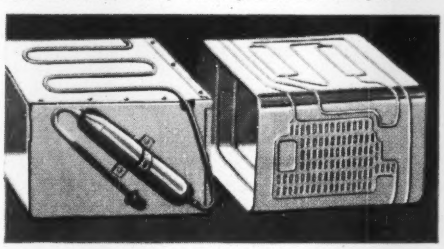
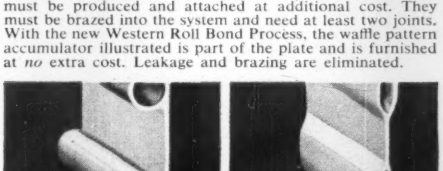


All other evaporators require separate accumulators which must be produced and attached at additional cost. They must be brazed into the system and need at least two joints. With the new Western Roll Bond Process, the waffle pattern accumulator illustrated is part of the plate and is furnished at *no* extra cost. Leakage and brazing are eliminated.



For automatic defrosting, the surface of a Western Roll Bond evaporator is entirely free of voids and pockets. This eliminates any possibility of moisture collecting and causing "frost blisters" that separate the tubing from the wall.

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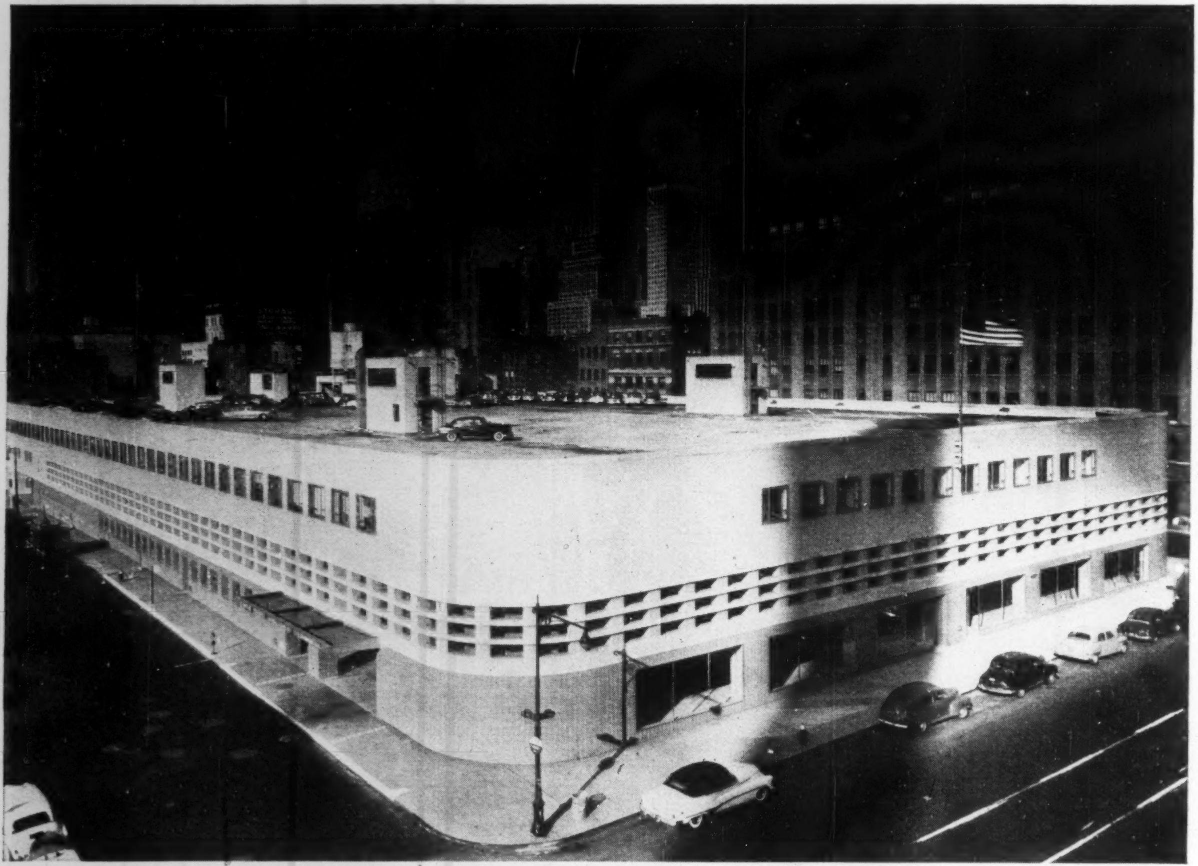

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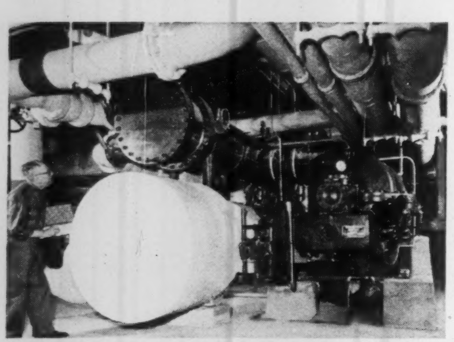
. . . cools 35,000 airline passengers a day



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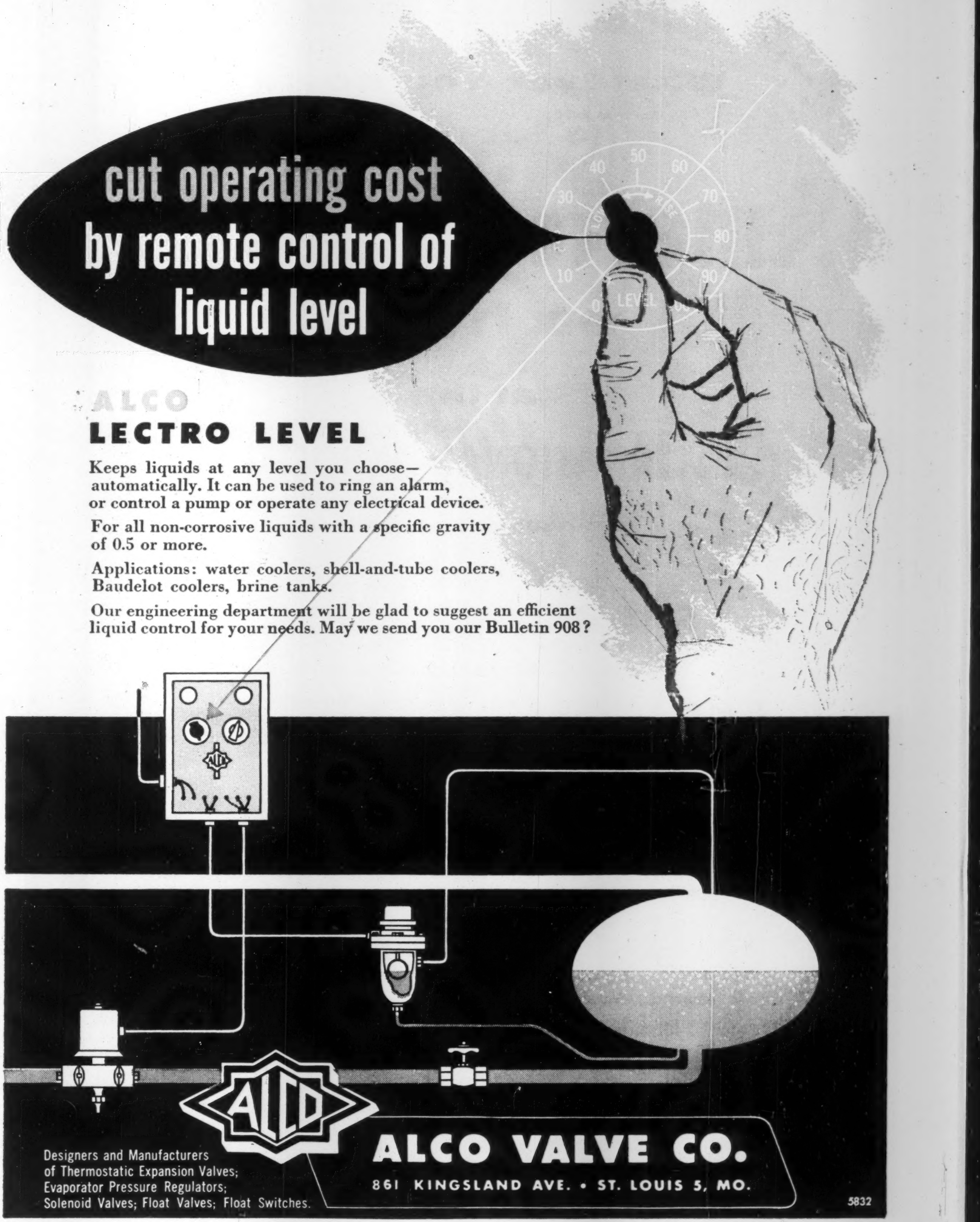

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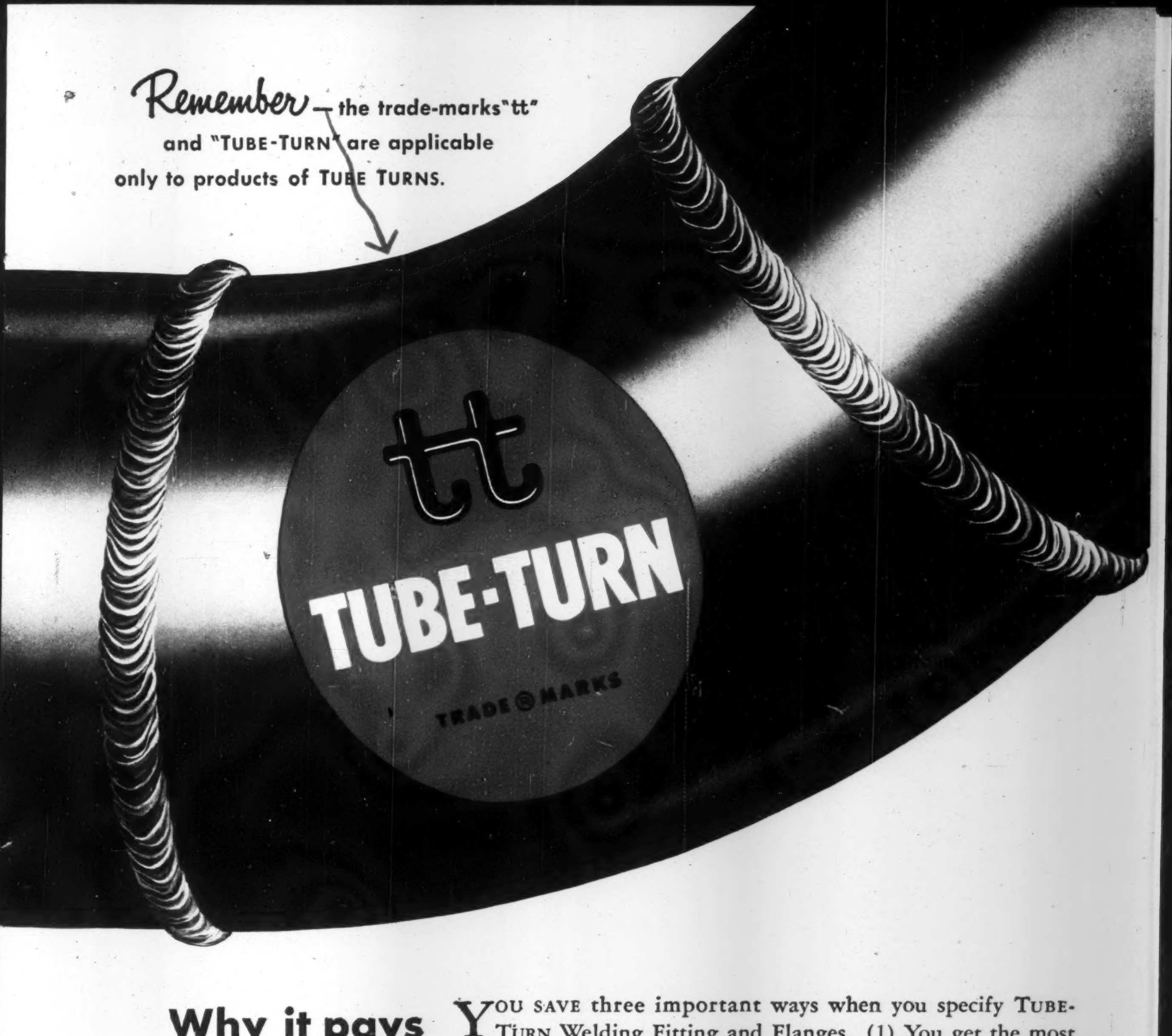

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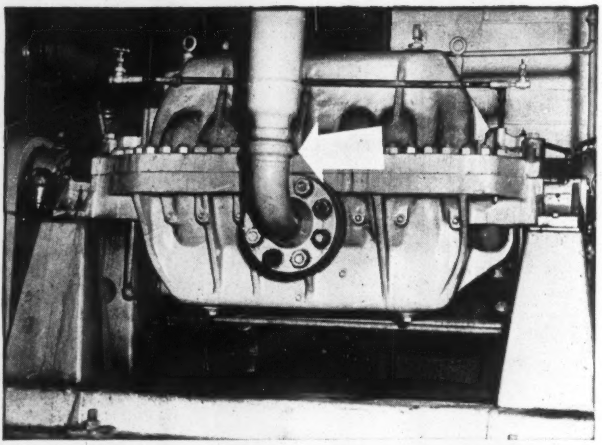

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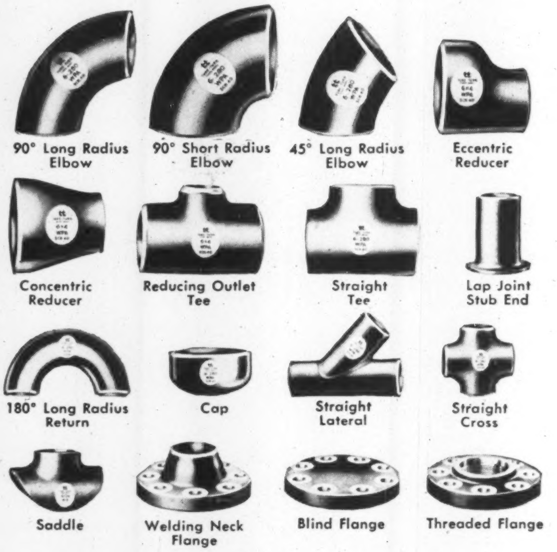
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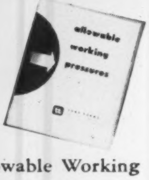
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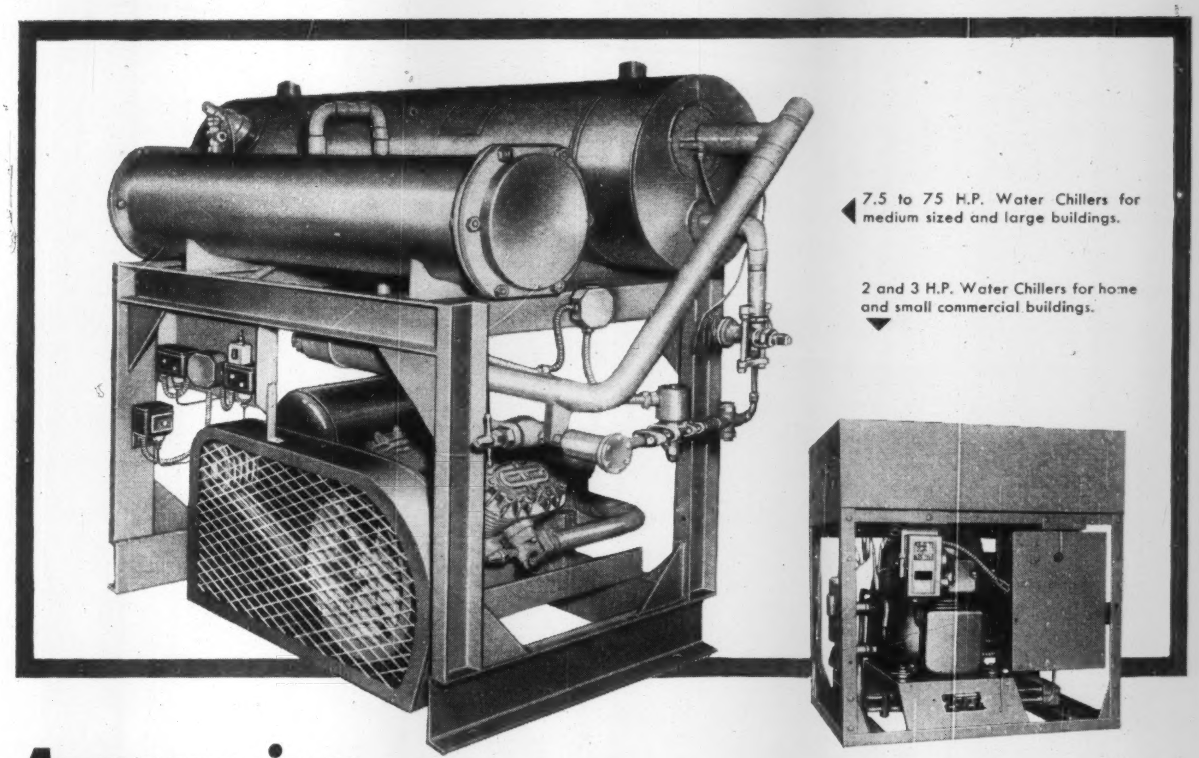
"tt" and "TUBE-TURN"
Reg. U.S. Pat. Off

TUBE TURNS

LOUISVILLE 1, KENTUCKY
A DIVISION OF NATIONAL CYLINDER GAS COMPANY



7.5 to 75 H.P. Water Chillers for medium sized and large buildings.

2 and 3 H.P. Water Chillers for home and small commercial buildings.

Announcing
new American-Standard Water Chillers that you can install in half-an-hour

New American-Standard Water Chillers come factory assembled with circuits completely piped, wired and tested. Just make a few simple electrical and plumbing connections and the chiller is installed.

There are two basic American-Standard chiller packages ranging from 2 to 75 H.P. One, for use in homes or small commercial buildings, is available in 2 and 3 H.P. sizes. Large chillers, for medium and large buildings, range in size from 7.5 to 75 H.P. All American-Standard Water Chillers come mounted in a rigid steel frame for easy handling.

The 2 and 3 H.P. water chillers have a hermetically-sealed motor and compressor assembly. You can get a 20-gauge steel jacket for the chiller, too. It comes in a handsome Forge Red color, and has a removable front cover.

Big American-Standard Chillers have low-speed compressors for extra quiet operation.

These new chillers are just the thing for a cold water source for all air conditioning systems. For more information about the new packaged water chillers or the complete Remotaire System, fill out and return the attached coupon to the **American Radiator & Standard Sanitary Corporation,** Pittsburgh 30, Pennsylvania.

American-Standard
Dept. HP-124, Pittsburgh 30, Pa.

Please send me literature on:

☐ 2 and 3 H.P. American-Standard Water Chillers
☐ 7.5 to 75 H.P. American-Standard Water Chillers
☐ the complete Remotaire Heating and Cooling System

Name..
Address..
City.............................State..............

AMERICAN-STANDARD PRODUCTS

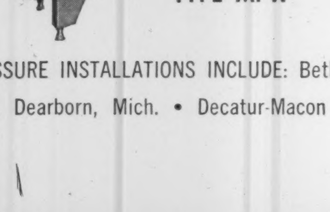
AMERICAN-Standard
WATER HEATING-COOLING SYSTEMS

Serving home and industry: AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS & WALL TILE • DETROIT CONTROLS • KEWANEE BOILERS • ROSS EXCHANGERS • SUNBEAM AIR CONDITIONERS

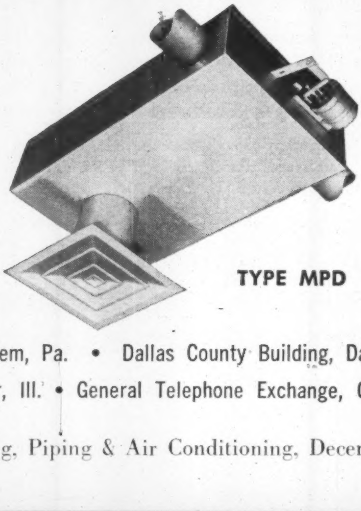
Air Conditioning Systems are on a diet...

thanks to

Tuttle & Bailey High Pressure Air Distribution Units



TYPE MPW



TYPE MPD

T&B HIGH PRESSURE INSTALLATIONS INCLUDE: Bethlehem Steel Co., Bethlehem, Pa. • Dallas County Building, Dallas, Texas Dearborn Bank, Dearborn, Mich. • Decatur-Macon County Hospital, Decatur, Ill. • General Telephone Exchange, Chicago, Ill.

If you can reduce the space you need for an air conditioning system, you can obviously effect substantial savings in the over-all cost of a building. With a high pressure air conditioning system, you can do just that.

Small, low-cost conduit-type risers and branch feeders add more usable or rentable floor space, reduce floor-to-floor dimensions, and require fewer supplementary equipment rooms.

High pressure is the ideal type of air conditioning system for new multi-story office buildings, schools, hospitals, hotels, and institutions. It is also *particularly* well suited to installation in existing buildings where high pressure eliminates the need for major remodeling. In fact, in many older buildings, such a system is the *only* answer to air conditioning.

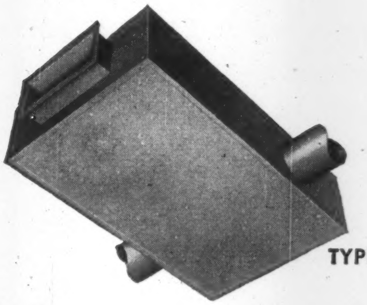
A pioneer in the development of the high pressure theory, Tuttle & Bailey manufactures a complete line of equipment to meet the varied requirements of a wide range of buildings and types of construction. Tuttle & Bailey Units include single and double duct wall and ceiling types for individual unit or zone control, and are capable of handling branch duct velocities up to 4000 feet per minute.

The units shown below typify the Tuttle & Bailey line which is backed by extensive on-the-job experience, and one of the best-equipped Research Laboratories in the industry where T&B engineers can duplicate field conditions and pretest equipment and thus offer maximum assistance to architects and engineers.

To learn how you can take advantage of Tuttle & Bailey's high pressure know-how, get in touch with your nearest T&B Representative or the Home Office.

For information on the complete line of Tuttle & Bailey High Pressure Air Distribution Units, write for Bulletin 109.

TUTTLE & BAILEY inc
NEW BRITAIN, CONN.



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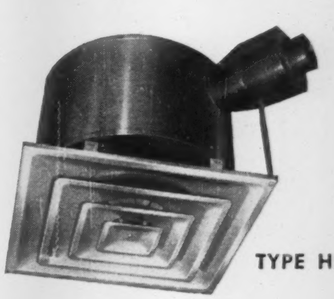
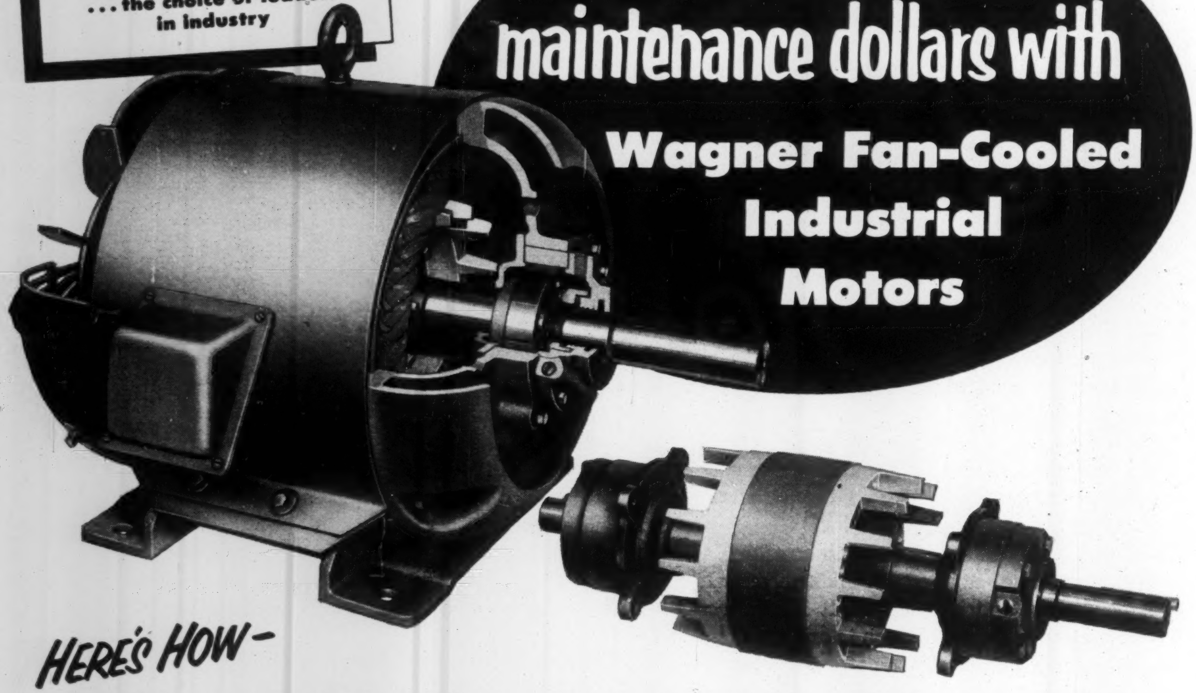


TYPE HPD

IBM World Headquarters, New York, N.Y. • Latter Day Saints Society Building, Salt Lake City, Utah • Lever House, New York, N.Y. People's National Bank, Little Rock, Ark. • Seamen's Bank for Savings, New York, N.Y. • Sinclair Oil Building, Tulsa, Okla.

Wagner®
ELECTRIC MOTORS
. . . the choice of leaders in industry

SAVE maintenance dollars with Wagner Fan-Cooled Industrial Motors



HERE'S HOW-

the Wagner Cartridge Bearing Design cuts your maintenance costs:

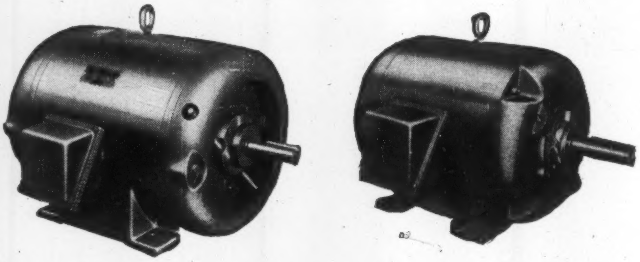
Bearings are protected at all times. The Wagner design completely encloses the bearings in a sealed cartridge. Labyrinth seals prevent the entrance of water, dirt and other foreign material. Even when the motor is disassembled, the cartridge remains intact as part of the rotor shaft. The bearing housing stays completely enclosed for full protection against dirt and dust.

Wagner Bearings can be relubricated. When lubrication is necessary to forestall premature bearing failure in unusually severe applications, readily accessible lubrication openings permit addition of grease or complete relubrication.

Wagner Bearings run longer between grease periods. Hot bearings shorten grease life. Wagner bearings have a low temperature rise because the design incorporates a deflector shield that directs a cooling stream of air around the bearing housing. Bearings run cooler and longer between maintenance periods.

This cartridge bearing design is a feature of the entire Wagner line of totally-enclosed fan-cooled motors. The line includes standard and explosion-proof steel frame motors, and standard and explosion-proof cast iron frame motors. All types are available with normal torque or high torque characteristics, in ratings to 250 hp.

For complete information—just call the nearest of our 32 branch offices, or write for Bulletins MU-132 and MU-196.



Wagner Electric Corporation
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WAGNER ELECTRIC CORPORATION
6370 PLYMOUTH AVE., ST. LOUIS 14, MO., U.S.A.

BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

ELECTRIC MOTORS
TRANSFORMERS
INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS—AIR AND HYDRAULIC

154-16

It's Quality Deserves Consideration

FISHER®

LEVEL-TROL®

FLOAT CENTER

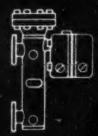
Factory calibrating or zeroing adjustment produces a correct 3 to 15 pound signal output for full float range operation, as particularly required in liquid level indication. Output signal of controller is linear as related to level height change.

Simple level adjustment indicating dial.

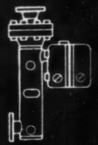
Pneumatic proportional band and specific gravity adjustment combined in one member.

Small compact relay unit, minimum working parts.

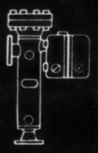
★ All welds are in accordance with ASME code for unfired pressure vessels.



UPPER and LOWER SIDE CONNECTIONS



TOP and LOWER SIDE CONNECTIONS



UPPER SIDE AND BOTTOM CONNECTIONS

Universally Accepted for

- **LIQUID LEVEL CONTROL**
- **LIQUID LEVEL INDICATION**
- **INTER FACE CONTROL**

Engineered for peak performance the Fisher Series 2500 Level-Trol is designed to give rugged, trouble-free service.

It is high in sensitivity and accuracy . . . it is versatile in handling all kinds of liquids, with minimum service attention.

Fisher Bulletin F-3 gives full details . . . write for your copy today!

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WORLD LEADER IN RESEARCH FOR BETTER PRESSURE AND LIQUID LEVEL CONTROL

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Johns-Manville
ARCHITECTURAL AND ENGINEERING
JOHNS-MANVILLE JM PRODUCTS
INSULATION SPECIFICATIONS
CONDENSED FORM
• Heated Vessels and Equipment
• Heated Piping
• Refrigerated Vessels and Equipment
• Air Conditioning Ducts
• Refrigerated Piping
Contains recommendations on
• proper type of insulation
• economic thickness
• right finish
• correct application

This new J-M Manual simplifies insulation specification writing

THIS MANUAL covers the architectural and engineering specifications for thermal insulations used in residences, commercial buildings, institutions and a wide variety of manufacturing plants.

These specifications are backed by almost a century of Johns-Manville experience in insulation engineering. As a result of this experience Johns-Manville today offers architects, engineers and users of insulations *complete* insulation service.

J-M Materials are available for every service temperature from minus 400F to plus 3000F. They include: J-M 85% Magnesia, Superex® and Rock Cork®, in pipe and block insulation form; Spintex, flexible duct insulation; as well as such finishing materials as Insulkote®, Asbestocite® and insulating cements.

J-M Engineering assures scientifically correct insulations for every job. J-M Engineers are called upon to solve insulation problems of every magnitude in every industry. Moreover, they have the resources of the Johns-Manville Research Center, largest laboratory of its kind in the world, where new and improved products are constantly being developed.

J-M Application assures long, trouble-free service with maximum performance from the insulation. Johns-Manville has a nation-wide organization of Insulation Contractors, staffed with men skilled in the application of J-M Insulations according to proven Johns-Manville methods.

JOHNS-MANVILLE JM PRODUCTS

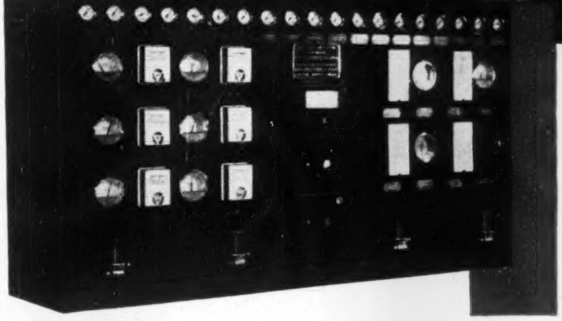
Write today for your free copy of Architectural and Engineering Insulation Specifications Booklet DS649. Simply address Johns-Manville Box 60, New York 16, New York.

Johns-Manville *FIRST IN* INSULATION

MATERIALS • ENGINEERING • APPLICATION

EVERY ROOM WEATHER-PERFECT!

it's another Air Conditioned Hospital with JOHNSON CONTROL



The Moses H. Cone Memorial Hospital, Greensboro, N. C. Samuel Hannaford and Sons, architects, Cincinnati, Ohio; Loewenstein-Atkinson Associates, supervising architects, Greensboro; Watson and Hart, mechanical engineers, Greensboro; W. H. Singleton Co., Inc., heating and air conditioning contractors, Arlington, Va.

Left, panel-mounted Johnson Control System automatically regulates the temperature and humidity of the primary air supply for room air conditioning units.

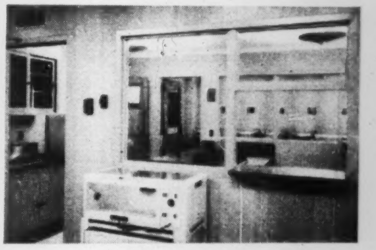
In the modern 300-bed Moses H. Cone Memorial Hospital, correct temperatures and humidities for every need are effortlessly and accurately provided by an up-to-the-minute system of Johnson Automatic Temperature and Humidity Control.

Four Johnson controlled year 'round air conditioning systems serve the vital areas, dining rooms and canteens. Strategically located Johnson *Individual Room* Thermostats and Room Humidostats respond instantly and continuously to the most exacting demands in the operating rooms, delivery rooms, nurseries and other vital areas. Optimum temperatures and humidities prevail constantly.

In the patients' rooms, Johnson Heating-Cooling Thermostats regulate Water Valves on the supply of hot and cold water in Carrier Weathermaster room air conditioning units, maintaining each room at precisely the prescribed temperature. In addition to this *individual room* control, behind the scenes Johnson Master-Submaster Control regulates the temperature and humidity of the large primary air system which supplies the individual room units.

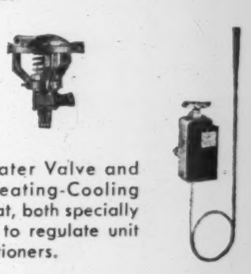
Johnson Control, throughout the entire hospital, produces maximum comfort and faster recovery for patients, permits hospital personnel to concentrate on technical duties and insures the greatest return from every dollar spent for heating and cooling. Above all, *pneumatically operated* Johnson Control is completely safe, *even in the presence of explosive anesthetic gases.* And Johnson Humidity Control guards against static electricity.

Any building—small or large, new or existing—can enjoy the unique comfort and fuel saving advantages of a Johnson-engineered temperature control system. Whatever your control problem, it will pay you to talk it over with an engineer from a nearby Johnson branch. There is no obligation. JOHNSON SERVICE COMPANY, Milwaukee 2, Wisconsin. Direct Branch Offices in Principal Cities.



Johnson Thermostats and Humidostats insure optimum temperatures and humidities in nurseries, operating rooms and other vital spaces.

Each patient room is maintained at the desired temperature level by Johnson Thermostats and Valves controlling the room air conditioning units.



V-152 Water Valve and T-271 Heating-Cooling Thermostat, both specially designed to regulate unit air conditioners.

JOHNSON CONTROL

TEMPERATURE ⇅ AIR CONDITIONING

MANUFACTURING • PLANNING • INSTALLING • SINCE 1885

A REPORT FROM Roll-O-MATIC'S FIRST (AND TOUGHEST) CUSTOMER!

American Air Filter

AAF General Office Building Serves as Proving Ground for New Automatic, Renewable Media Air Filter!

IT looked good on paper; was sensational in the laboratory. But how would it measure up in actual day-to-day service? AAF's General Office Building air conditioning system was selected as the "guinea pig" long before the ROLL-O-MATIC ever made a public appearance.

Never has a filter had a more critical customer. Cleaning efficiency of the bonded glass fiber "blanket" was instrument-checked regularly. Media usage was measured meticulously. Every mechanical feature was observed and evaluated under true service conditions.

After months of this "filter clinic", ROLL-O-MATIC's first customer is also its most enthusiastic. AAF engineers have positive proof of this unit's maintenance-free operation. They know that ROLL-O-MATIC can deliver clean air continuously at an operating cost less than half that of a disposable type filter of equal capacity.

Yes, ROLL-O-MATIC efficiency and cost-cutting operation is a matter of record—a record which is now being duplicated by many installations. For complete facts, contact your local AAF representative or write for Bulletin No. 248.

AAF

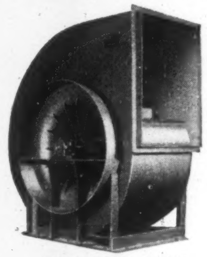
herman nelson

American Air Filter
COMPANY, INC.

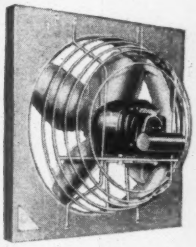
American Air Filter of Canada, Ltd., Montreal, P. Q. • 373 Central Avenue, Louisville 8, Kentucky

BEST GIFT for your PLANT

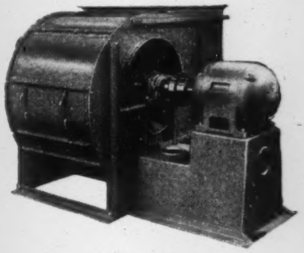
DEPENDABLE "BUFFALO" FANS with the FAMOUS "Q" Factor*



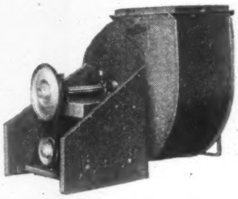
TYPE "BL" FANS
In sizes for 1,000 to 500,000 cfm, these new non-overloading fans for general ventilation and air conditioning offer even finer performance than their famous predecessors, the "LL" Fans.
NEW BULLETIN F-100



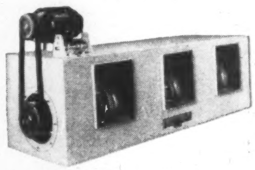
New! NV-BREEZO FANS
Their specially-shaped four-blade wheel gives high efficiency even against system pressures of 1/4" and 1/2". 8" to 24" sizes.
BULLETIN 3865



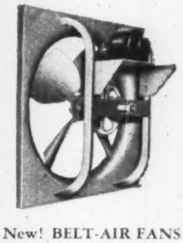
DRAFT FANS
"Buffalo" mechanical Draft Fans are helping turn out low-cost steam in plants and major utility stations everywhere.
BULLETIN 3750



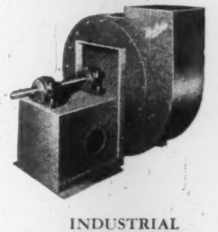
BELTED VENT SETS
Non-overloading ventilating fans for duct or free air delivery. Extra quiet.
BULLETIN 3720



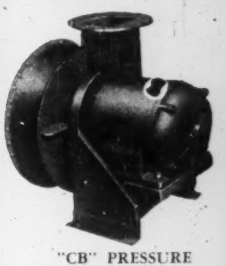
SHORTBOY VENTILATING SETS
Quiet, efficient, vibration-free fans. Wheels mounted on hollow shaft.
BULLETIN 3701



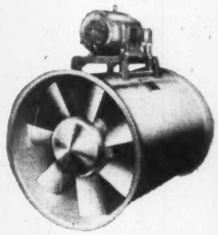
New! BELT-AIR FANS
Quiet, sturdy fans to move a lot of air at negligible cost. Heavy-gauge die-stamped blades and panel.
WRITE FOR DETAILS



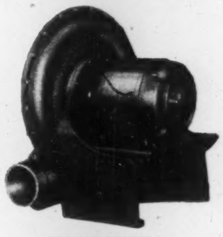
INDUSTRIAL EXHAUSTERS
All-welded for strength and high efficiency. With air or material wheels.
BULLETIN 3576



"CB" PRESSURE BLOWERS
Up to 2 1/4 psi, single stage with these husky, space-saving units!
BULLETIN 3553



AXIAL FLOW FANS
Compact, light, highly efficient ventilating fans for light duty.
BULLETIN 3533



"E" BLOWERS-EXHAUSTERS
For low to medium pressures and volumes in draft, cleaning, line boosting.
BULLETIN 3014

VOLUME FANS
Rugged blowers-exhausters with cast iron housings and dust-proof ball bearings for any job up to 10" s.p.
BULLETIN 3615

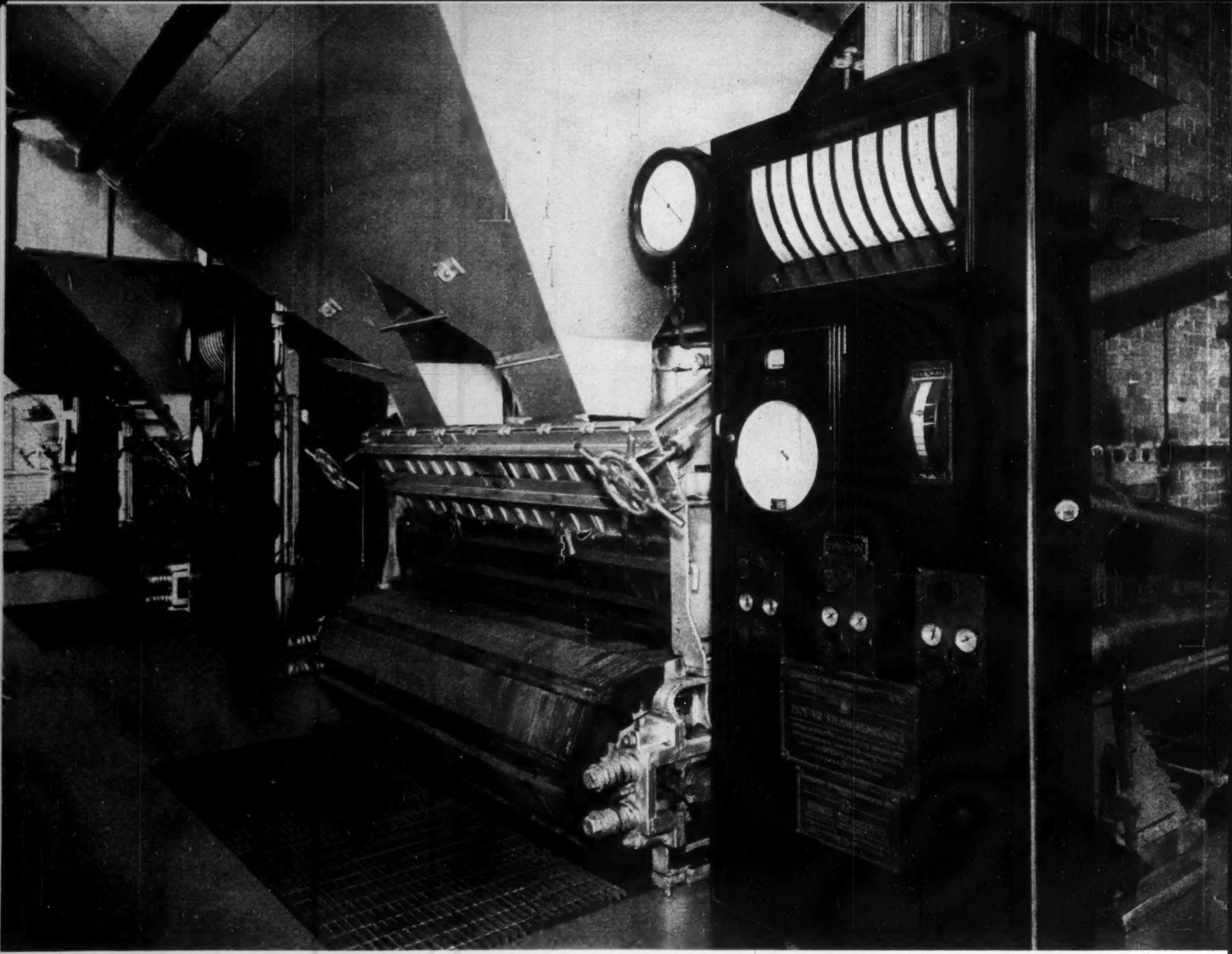
"Buffalo"

*The "Q" Factor — *The built-in Quality which provides trouble-free satisfaction and long life.*

BUFFALO FORGE COMPANY

171 MORTIMER ST. BUFFALO, NEW YORK
PUBLISHERS OF "FAN ENGINEERING" HANDBOOK
Canadian Blower & Forge Co., Ltd., Kitchener, Ont.
Sales Representatives in all Principal Cities

FORGED DRAFT PRESSURE BLOWING HEATING COOLING VENTILATING AIR CLEANING AIR TEMPERING INDUCED DRAFT EXHAUSTING



Pennsylvania R. R. saves $33,000 a year by burning coal the modern way

The Lafayette Street Power Plant of the Pennsylvania Railroad in Fort Wayne, Indiana, heats a passenger station, office buildings and repair shops. In addition, it also supplies steam for power, processing and car heating. To increase the efficiency of this coal-fired plant, the railroad replaced its old boilers with modern steam generating equipment, regulated by automatic combustion controls. At the same time, they modernized the ash removal system.

Today the cost of steam generation has been lowered from 77c to 59c per 1,000 pounds and combustion efficiency raised 25% higher than before. Overall heating costs have been cut $33,000 yearly.

Investigate Your Fuel Costs

If you're planning to modernize your plant or build a new one—or if you are just interested in cutting fuel costs—find out how coal, burned the modern way, compares to other fuels. Talk to a consulting engineer or your nearest coal distributor. Their advice may save you thousands of dollars every year.

facts you should know about coal

In most industrial areas, bituminous coal is the lowest-cost fuel available.

Up-to-date coal burning equipment can give you 10% to 40% more steam per dollar.

Automatic coal and ash handling systems can cut your labor cost to a minimum.

Coal is the safest fuel to store and use. No dust or smoke problems when coal is burned with modern equipment.

Between America's vast coal reserves and mechanized coal production methods, you can count on coal being plentiful and its price remaining stable.

For further information or additional case histories showing how other plants have saved money burning coal, write to the address below.

BITUMINOUS COAL INSTITUTE
A department of National Coal Association
Southern Building, Washington 5, D.C.

begin your Fan and Blower jobs with "Peerless Middle-Size Job Plan"

It's faster

Here's a plan that spells savings for you all along the line . . . from the bid to the final inspection. With this plan, you take any job in your area and Peerless does the engineering at no cost to you. It's fast, economical and practical. You'll bid better, install better and make more profits because you have direct service from the main office. Trouble-free Peerless Fans and Blowers cut installation costs, eliminate expensive callbacks and carry the ironclad Peerless Electric guarantee. Put the Peerless Middle-Size Job Plan to work. Send us the engineering details on your next job.

Get on the high road to bigger profits with Peerless.

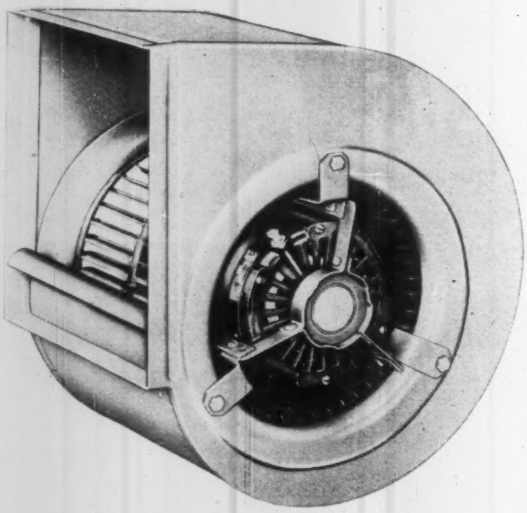
FAN AND BLOWER DIVISION
THE PEERLESS ELECTRIC COMPANY
1409 WEST MARKET ST. · WARREN, OHIO

Peerless Electric
FANS·BLOWERS
"Smoothest Performers on the market"
THE PEERLESS ELECTRIC COMPANY
WARREN, OHIO

Peerless Electric

GO DIRECT TO UTILITY FOR SILENCE

IN DIRECT DRIVE BLOWERS



A lot of air doesn't have to make a great big noise. As a matter of fact, Utility's Direct Drive Blowers have practically no-sound operation due to the new Neoprene hubs which isolate motor noise and vibration. The first to utilize this far-advanced feature, Utility consistently pioneers in high speed production development. This enables us to pass on to you the top quality of our engineering combined with a rock-bottom price.

Adaptable to the manufacture of heating, cooling, refrigerating and ventilating equipment, these silent direct drive blowers also require less space, have no unnecessary accessories and can be speed-controlled easily.

Tested and re-tested, they are the product of Utility's advanced engineering and low-cost production techniques. You can now offer your customers the kind of equipment that includes silent operation and all other Utility exclusive features. Check Utility for blowers, blower parts or any combination of parts — and discover for yourself . . .

YOU CAN'T MATCH UTILITY FOR PRODUCT AND PRICE

A Division of Utility Appliance Corporation

UTILITY FAN CORPORATION

911 East 59th Street, Los Angeles 1, California

Producers of blowers and blower parts for original equipment manufacturers. Manufacturers of heavy and standard duty blowers for heating, air conditioning and ventilating installations. Write for catalogue data.

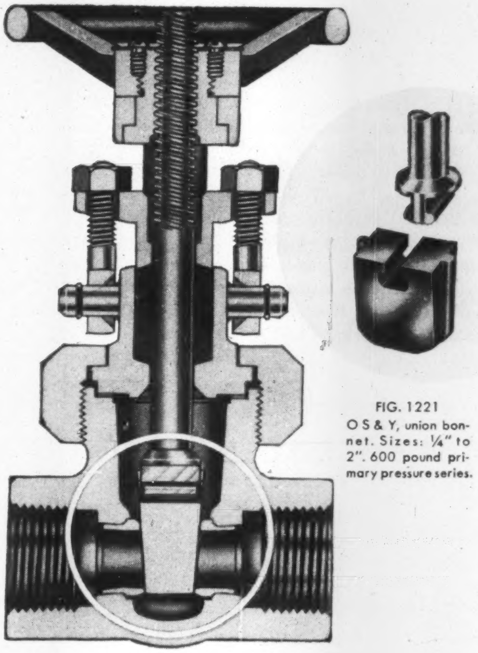


FIG. 1221
O S & Y, union bonnet. Sizes: ¼" to 2". 600 pound primary pressure series.

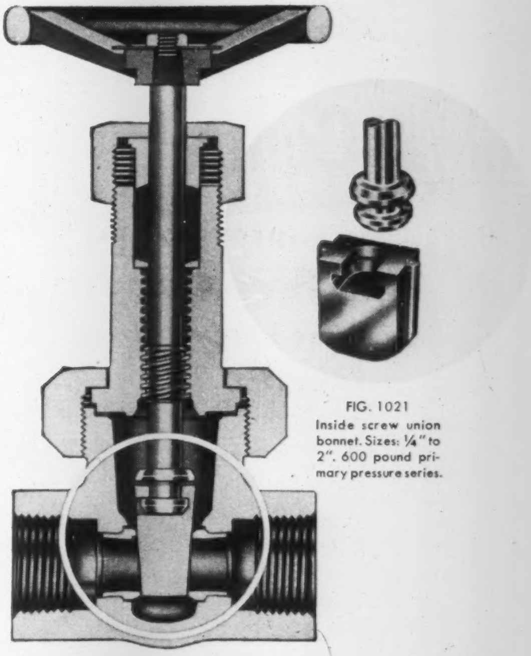


FIG. 1021
Inside screw union bonnet. Sizes: ¼" to 2". 600 pound primary pressure series.

New design makes OIC forged steel gate valves the most modern line . . .

NEW: stronger stem-to-wedge connection. Improved, modern design increases pull-out strength to many times the theoretical requirement. This design distributes the pull-out load more efficiently throughout the wedge structure to meet the most stringent specifications of valve buyers in all fields.

NEW: wedges wear longer. Wedges are made of 13% chrome stainless steel for corrosion resistance. They are duracased to at least 1000 Brinell Hardness to prevent galling and excessive wear caused by frequent closures upon foreign particles in the flow.

NEW: union bonnet design is more efficient. Body-to-bonnet joint of the male-female type provides a recess for the gasket. It is contained more securely, reducing the possibility of leakage or a blown gasket.

OTHER OUTSTANDING FEATURES

Stem threads of all OIC inside screw, forged steel valves are always contained inside the bonnet. They can't possibly load up with corrosive matter which might be in the flow. This keeps the threads clean and free running, and contributes to longer stem wear.

Modern OIC Seal-Ever packing is a special composition which eliminates electrolytic action between the stem and the packing. This prevents stem corrosion in the packing area and helps maintain a leakproof seal.

Back-seating feature provides means of repacking valves while in service.

OS & Y valve gland "I" bolts are retained on trunnions by modern, more efficient, stainless steel snap rings.

Shoulder-type seat rings are expanded into the body under heavy pressure. They are accurately machined to mate tightly with the wedge for a positive seal.

Order modern OIC Forged Steel Valves from your nearby OIC Distributor. Write and request Folder No. 195.

OIC Forged Steel Valves are also available in globes, angles and checks in a variety of trims for any service.

THE OHIO INJECTOR COMPANY • WADSWORTH, OHIO

OIC
FOUNDED 1883
VALVES

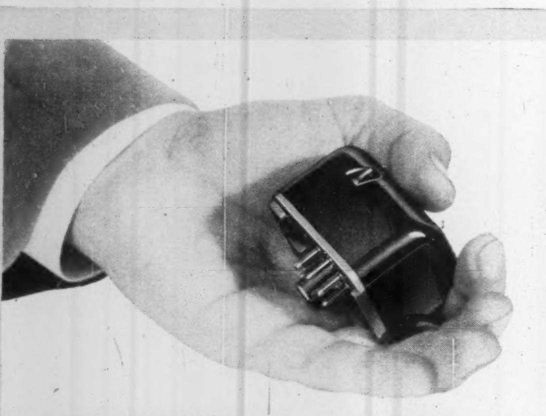
FORGED & CAST STEEL, LUBRICATED PLUG, BRONZE & IRON

BARBER COLMAN

Electronic Controls

...provide most advanced control systems known today

Hitherto unknown flexibility in control of temperature and humidity is now yours with Barber-Colman's extensive developments in electronic circuits. Fortunately, Barber-Colman started in electronics way back in 1926, when the radio-controlled garage door was pioneered. Then came process controls for textiles, electronic devices for aircraft. From the air, as it were, came the MICRORELAY used in d-c bridge circuits for planes. This ultra sensitive relay is the "heart" of the Barber-Colman amplifier—it reduces number of tubes, substantially decreases plate voltages on tubes (thus increasing tube life), provides stability, maintains control point at 0 volts, is plug-in type for easy servicing. Best of all, the Microrelay requires approximately *1000 times less power* than conventional relays. Here are just a few from the wide range of Barber-Colman electronic devices:



d-c MICRORELAY . . . ultra-sensitive relay—secret of Barber-Colman's superior amplifier!

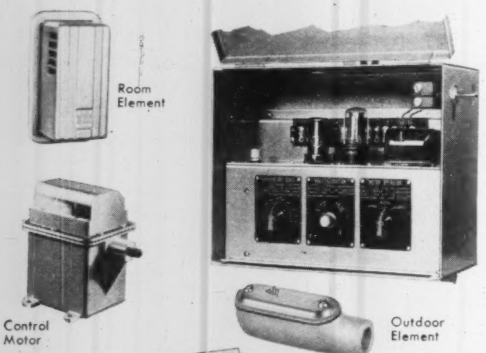
Electronic Hot Water Controls

FOR OUTDOOR RESET

◆Adjustable Ratio Electronic Control Panel
The most flexible hot water control on the market ◆
BARBER COLMAN
Controls
BARBER-COLMAN COMPANY

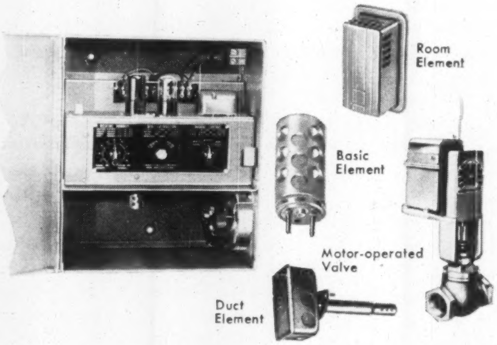
Electronic Temperature Controls

FOR HEATING, VENTILATING AND AIR CONDITIONING


Room Element
Control Motor
Outdoor Element

Electronic Humidity Controls

FOR HUMIDIFYING AND DEHUMIDIFYING SYSTEMS


Room Element
Basic Element
Motor-operated Valve
Duct Element

BARBER COLMAN
Hot Water Controls
Controls
Electronic humidity controls
The Electronic CONTROL STORY

LITERATURE KIT—get latest data bulletins, plus application drawings in this complete electronic literature kit now available to you for the asking. Call our nearby Field Office, or write today.

ENGINEERING ASSISTANCE—in your nearby Barber-Colman Field Office are engineers ready and willing to help you design the very best electronic, electric, or combination electronic-electric control system for each job. Call upon these experts for assistance on control problems.

BARBER-COLMAN COMPANY

Dept. L, 1301 Rock St.; ROCKFORD, ILL., U. S. A. Field offices in principal cities

Automatic Controls • Air Distribution Products • Industrial Instruments
Aircraft Controls • Small Motors • Overdoors and Operators • Molded Products • Metal Cutting Tools • Machine Tools • Textile Machinery

TRION

ELECTRONIC AIR CLEANERS

have the *leadership features* you need in modern air cleaning!

TRION

GUARANTEED AIR CLEANING EFFICIENCY OF 90% BY U. S. BUREAU OF STANDARDS DUST-SPOT TEST METHODS

plus

BUILT-IN WATER WASH SYSTEMS

Trion pioneered the built-in water wash system for easy and effective removal of collected dirt. Ionizers, insulators, collecting cells and air distribution media can be easily cleaned without entering the duct.

plus

UNITIZED IONIZING-COLLECTING CELL

Trion units are built with an all-aluminum ionizing-collecting cells with a venturi nozzle to prevent by-pass. The corona shield construction conserves power and increases efficiency.

plus

BUILT-IN DRY TYPE FILTERS

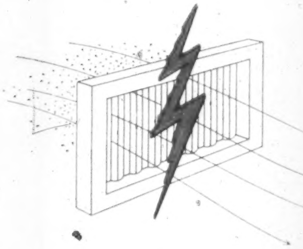
Dry type mechanical filters are built-in on the clean air side of each Trion unit to provide effective air distribution—another Trion first.

plus

MODERN POWER PACKS

Trion leads the field in modern power packs that feature accurate indicating instruments and fully magnetic circuit breaker assuring absolute control of operation.

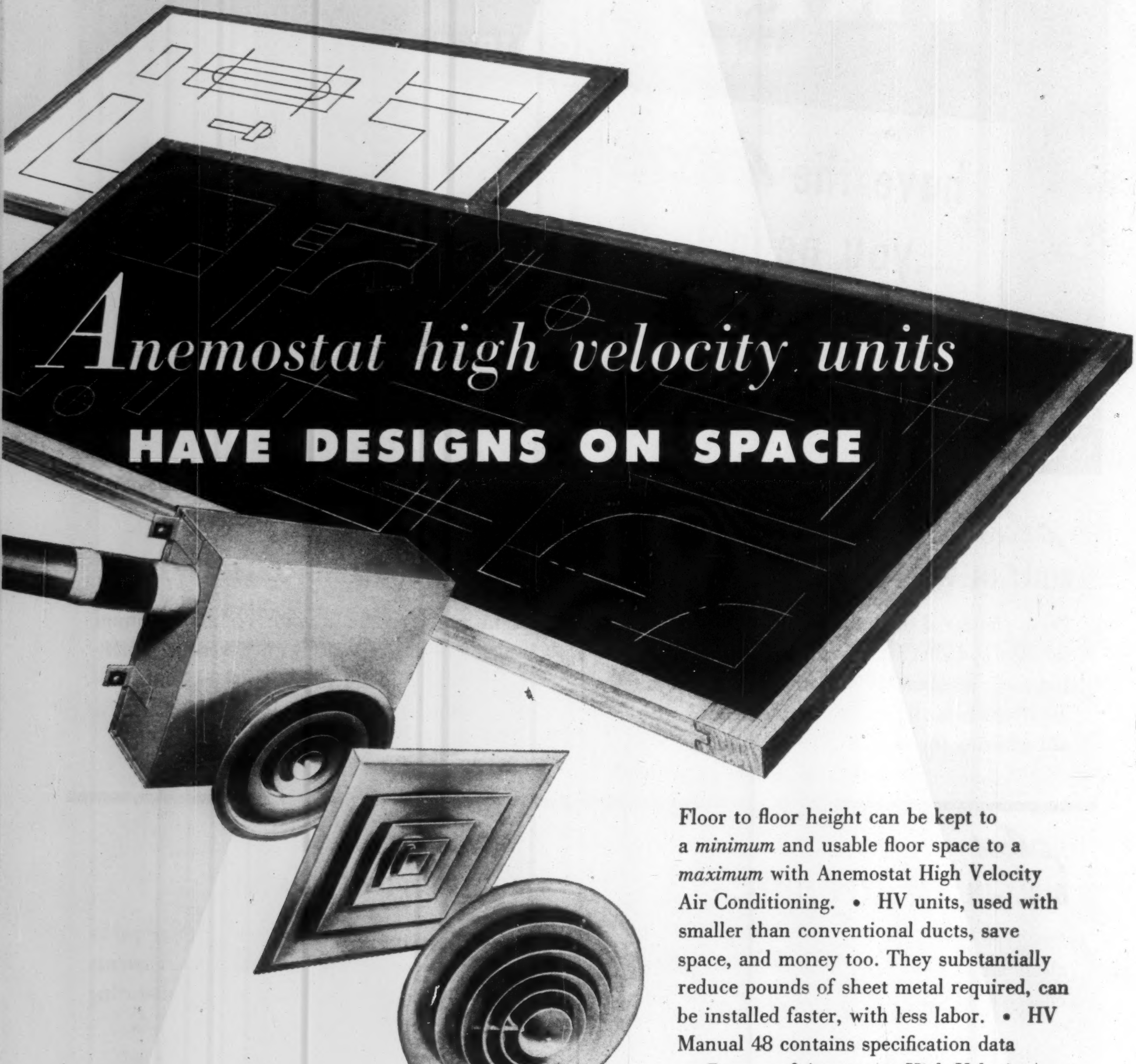
Write for the Free TRION Catalog E-60—
it has the facts you want!



TRION

TRION, INC.

1000 Island Avenue · McKees Rocks, Pa.
IN METROPOLITAN PITTSBURGH



Floor to floor height can be kept to a *minimum* and usable floor space to a *maximum* with Anemostat High Velocity Air Conditioning. • HV units, used with smaller than conventional ducts, save space, and money too. They substantially reduce pounds of sheet metal required, can be installed faster, with less labor. • HV Manual 48 contains specification data on 7 types of Anemostat High Velocity units, for all engineering and architectural requirements. Write for free copy.

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DRAFTLESS *Aspirating* **AIR DIFFUSERS**
ANEMOSTAT CORPORATION OF AMERICA
10 EAST 39th STREET, NEW YORK 16, N. Y.
REPRESENTATIVES IN PRINCIPAL CITIES

"No Air Conditioning System Is Better Than Its Air Distribution"

AC1824

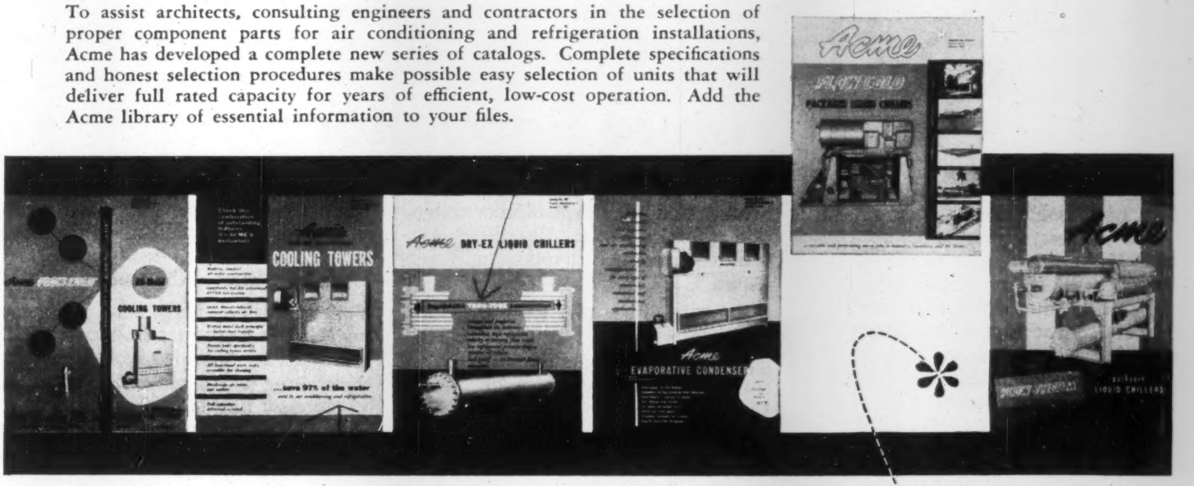
the **WHY** *of* **Acme LEADERSHIP**

in air conditioning and refrigeration engineering

Acme Industries, Inc., of Jackson, Michigan has been serving the Air Conditioning and Refrigeration industries since 1919. During that long span of years, Acme engineers have built a fount of knowledge and technical experience that enables them to design, build, and select products to fit any temperature control problem. Leading architects, engineers and refrigeration contractors have come to depend upon and insist upon Acme products in their installations. Long lists of satisfied Acme users line the ranks of American business and industry. You can look to Acme for superior performance in all phases of air conditioning and refrigeration.

the **Acme** *air conditioning and refrigeration library*

To assist architects, consulting engineers and contractors in the selection of proper component parts for air conditioning and refrigeration installations, Acme has developed a complete new series of catalogs. Complete specifications and honest selection procedures make possible easy selection of units that will deliver full rated capacity for years of efficient, low-cost operation. Add the Acme library of essential information to your files.



☐ Acme Flow-Cold Cooling Towers, 2 to 15 tons
☐ Acme Cooling Towers, 15 to 70 tons
☐ Acme Dry-Ex (Direct Expansion) Liquid Chillers
☐ Acme Evaporative Condensers
☐ Acme Flow-Cold Packaged Liquid Chillers, 2 to 15 tons
☐ Acme Flow-Therm Packaged Liquid Chillers to 220 tons

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Address..
City.. Zone........................
State..

ACME AIR CONDITIONING REFRIGERATION

ACME INDUSTRIES, INC.

JACKSON, MICHIGAN

Manufacturers of Quality Air Conditioning and Refrigeration Equipment since 1919

- Evaporative Condensers
- Cooling Towers — 2 to 70 tons
- Blo-Cold Unit Coolers
- Dry-Ex (direct Expansion) Liquid Chillers
- Shell-and-Tube, Shell-and-Coil Condensers
- Flow-Cold packaged Liquid Chillers to 15 tons
- Flow-Therm packaged Liquid Chillers to 220 tons
- Heat Exchangers
- Liquid Receivers
- Flow-Temp Heat Pumps
- Remote Room Conditioners
- Oil Separators

How to Select an Economical Temperature Regulator

First of all, what does *economy* mean where temperature regulators are concerned? In some industries it means improvement of product or reduction of spoilage through closer control of process temperatures. In others, it means the paring down of operating expense. The price of the regulator itself is a relatively small factor.

Today's buyers are shopping for:

1. Accuracy of control — not only when the regulator is new, but throughout its service life
2. Dependability — to prevent loss of production time
3. Minimum installation and maintenance cost

Here are a few tips on what to look for when you're installing a new or replacing an old temperature regulator —

Packless construction . . . and for this reason: A diaphragm operated, packless regulator minimizes friction. There are no closely fitted parts to stick or bind because of uneven expansion or collection of foreign matter. Also, there's less maintenance, since no repacking is ever required.

A guarantee against wire drawing of the seats and discs. Insist on it. This guarantee in combination with single seat design assures you of tight shutoff; you avoid expensive steam losses as well as loss of product in a process application.

Broad control range. In a standard regulator you should expect a control range of 100 F. And make sure the unit you select has a vapor tension thermostat that can take over-temperatures of at least 100 F.

Easy maintenance. Why ask for grief? Your temperature regulator should be basically simple in design so that it can be serviced by average plant personnel. All parts should be readily accessible for testing and cleaning.

Double duty. There's no point in buying a separate pressure regulator when you can select a temperature regulator that combines both temperature and pressure control within the same unit.

Self-operating. Make sure you get a regulator that operates on its own initial pressure. By doing so, you avoid the purchasing and maintenance of an air compressor plus air piping, and you're sure of uninterrupted operation during electric power failures.

• • • •

All of these points are important to you when it comes to selecting an economical temperature regulator. Perhaps you didn't realize you *could* expect so much. And perhaps you didn't realize that *Spence* Temperature Regulators offer all these features and more. May we send you our Bulletin T 500 containing further details?

SE 138

SPENCE ENGINEERING COMPANY, INC.
Walden, New York

where
top grades count . . .
SPANG CW

it's top grade SPANG® CW steel pipe

The children who study at Harper Elementary School, Evansville, Indiana, learn at a young age that in order to achieve the top grade they must put the best they can into their studies.

The men who planned and constructed this modern, well-equipped school also know that in order to build a really top-grade school they must install the best in materials. That's why Spang CW Steel Pipe was used for drainage lines, plumbing, hot and cold water lines, and steam lines from the boilers to the ventilators in this school.

Contractors and builders who are conscientious about top-grade materials specify Spang CW Steel Pipe because it offers these advantages:

1. The manufacture of Spang CW is quality-controlled from the careful selection of top grade skelp . . . through close metallurgical control during forming . . . to the finished product which is *doubly* inspected to assure you of a reliable product made for years of satisfactory service.
2. Spang CW pipe is easier to cut, weld, thread and bend making installation faster and keeping installation costs low.

It pays to get ***quality*** *when you specify pipe. It will pay you to specify Spang CW Steel Pipe. See your Spang Distributor.*

Owner: School City of Evansville, Indiana
Architect: Ralph Legeman Associates, Evansville, Indiana
Piping Contractor: Newman Brothers Inc., Evansville, Indiana
Spang Distributor: Plumbing & Industrial Supply Co., Evansville, Indiana
General Contractor: Balser Bros. Const. & Supply Co., Evansville, Indiana

SPANG

SPANG-CHALFANT
DIVISION OF THE NATIONAL SUPPLY COMPANY
General Sales Office: Two Gateway Center, Pittsburgh, Pennsylvania. District Sales Offices: Atlanta, Boston, Detroit, Houston, Los Angeles, New York, Philadelphia, Pittsburgh, St. Louis.

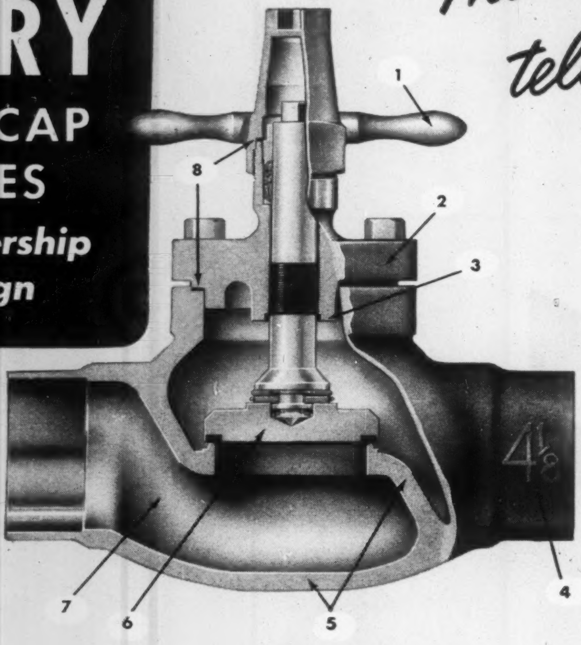
Back of the Unprecedented demand for

HENRY

WING CAP VALVES

is a Leadership in design

These features tell the story



1. WING CAP—with stem operating socket.
2. BOLTED BONNET for maximum safety.
3. BACK SEATING—can be repacked under pressure.
4. VALVE SIZE IDENTIFICATION—on Bronze body.
5. HEAVY WALL—Bronze alloy or Semi-steel for maximum strength.
6. PATENTED, NON-ROTATING SELF-ALIGNING SWIVEL DISC. Easy positive sealing. Minimum seat wear. Chatterproof.
7. FULL CAPACITY FLOW THROUGHOUT.
8. FULLY RETAINED POSITIVE SEALING GASKETS.

Available in bronze alloy and semi-steel types. Sizes range: ⅞″ to 5⅛″ O.D.S. and ½″ to 2″ F.P.T. Flanged valves available with brass O.D.S. or steel butt weld adapters, sizes 1⅜″ to 5⅛″.

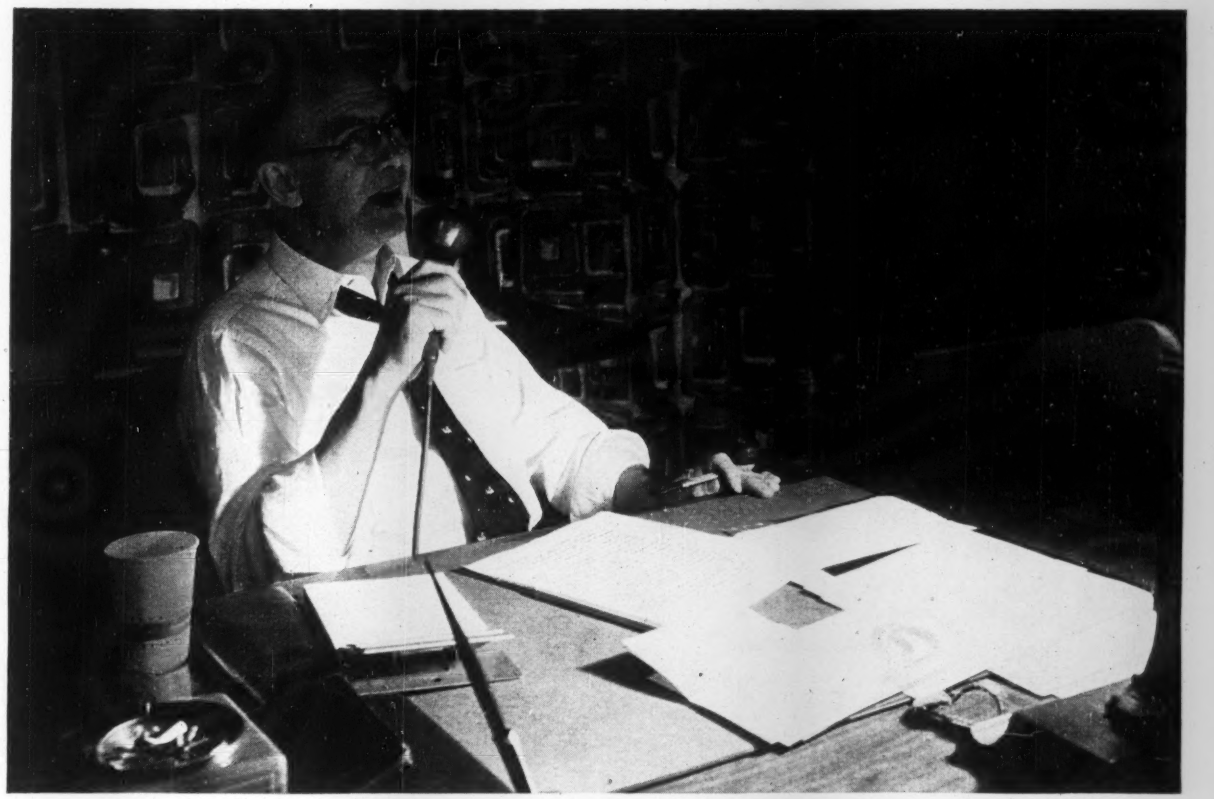
Year after year Henry Wing Cap Valves become more popular on both government and civilian refrigeration and air conditioning installations because of the high inherent quality of the valves and their features of design and construction. No other similar product carries such a universal recommendation by wholesalers or is in such wide demand among contractors and service men where the use of a wing cap valve is indicated.

HENRY VALVE CO.

Melrose Park, Ill. (Chicago Suburb)
Cable: HEVALCO, MELROSE PARK, ILLINOIS

HENRY VALVE CO.
CONTROLLING FLOW
SINCE 1914
®

Valves, Driers, Strainers, Control Devices and Accessories for Refrigeration and Air Conditioning and Industrial Applications



"We've been in the dark"

"Miss Jones—

"These notes cover what I intend to discuss at the committee meeting tomorrow. Please type them and attach them to the Wolverine proposal we received this morning. And set up my office for a 10:00 meeting tomorrow."

• • •

"Gentlemen:

"As you know we've been in the dark for some time as to how best increase the capacity of our heat exchangers. Space is at a premium, and the obvious answer of a larger heat exchange unit is out of the question.

"I've been talking to some of the men at Wolverine Tube and they've come up with what looks like the answer. They suggest using Wolverine Trufin*—their integral finned tube. Wolverine extrudes the fins right from the tube wall: Trufin is just about the most efficient tube I've ever seen. We can boost our output, improve our product at the same time.

"There are other advantages, too. Trufin can be bent or coiled just as easily as plain tube. In order to meet varying corrosive conditions, it's made in several metals: copper and copper-base alloys, aluminum, electric-welded and stainless steel, bi-metal and others.

"I've prepared some rough figures to show just what cost advantages we can expect from Wolverine. They've given me a quotation, too, which I'd like to go over with you." Wolverine Tube, 1461 Central Avenue, Detroit 9, Michigan.

EST. 1916

WOLVERINE TUBE
DIVISION OF CALUMET & HECLA, INC.

Manufacturers of Quality Controlled Tubing and Extruded Aluminum Shapes

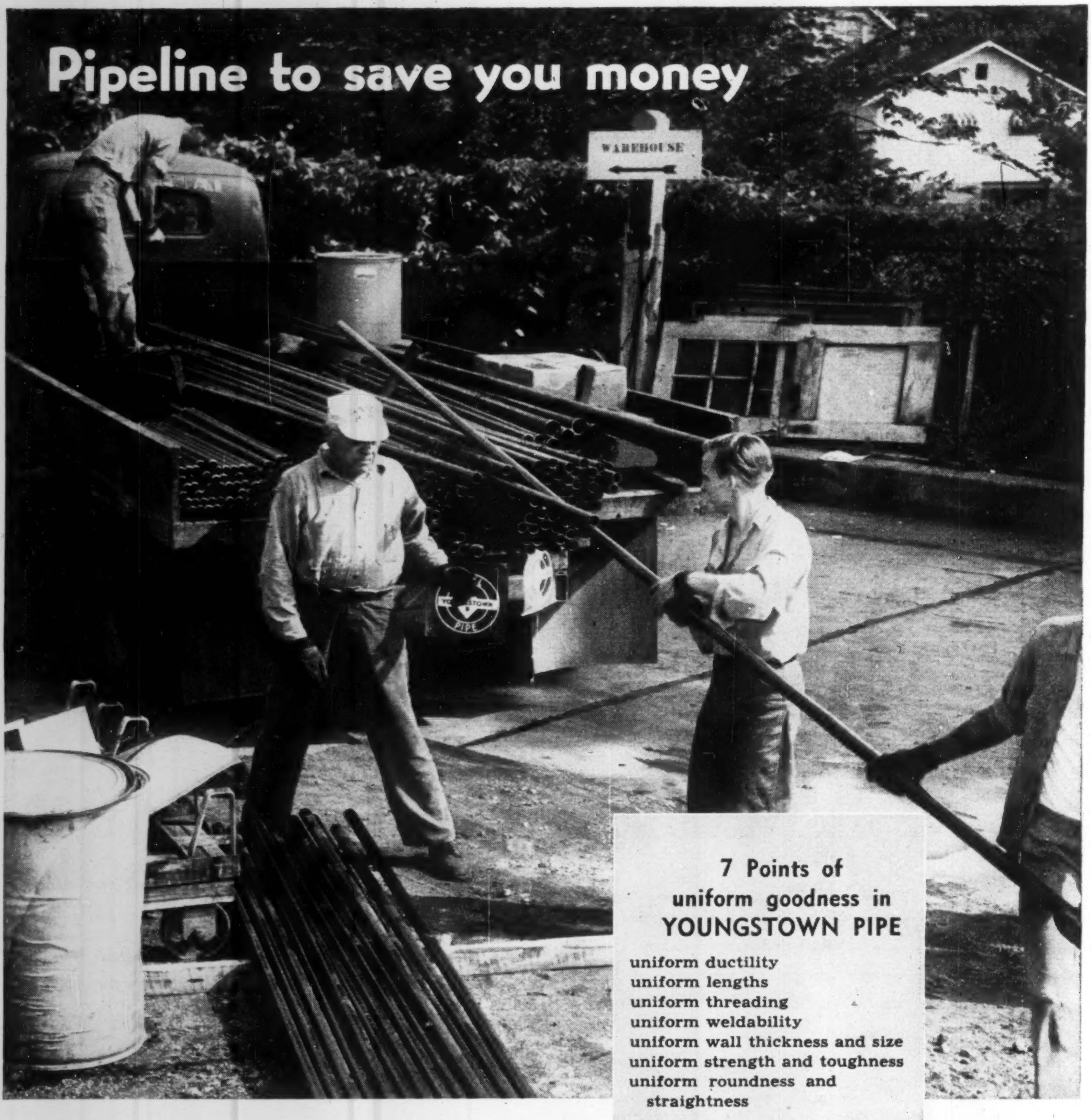
*REGISTERED U. S. PATENT OFFICE

Wolverine Trufin is available in Canada through the Unifin Tube Company, London, Ont.

PLANTS IN DETROIT, MICHIGAN, AND DECATUR, ALABAMA. SALES OFFICES IN PRINCIPAL CITIES.

EXPORT DEPARTMENT, 13 EAST 40TH STREET, NEW YORK 16, N. Y.

Pipeline to save you money



7 Points of uniform goodness in YOUNGSTOWN PIPE

uniform ductility
uniform lengths
uniform threading
uniform weldability
uniform wall thickness and size
uniform strength and toughness
uniform roundness and straightness

● Why not "run a pipeline" from your Youngstown Pipe Distributor right to your door? A phone call does the job. It gets you all the pipe you want when and where you want it. With a service "pipeline" to you, your Youngstown Distributor saves you the cost of maintaining your own pipe stocks. Why not call him?

Youngstown

QUALITY
YOUNGSTOWN
SERVICE

THE YOUNGSTOWN SHEET AND TUBE COMPANY *Manufacturers of Carbon, Alloy and Yoloy Steel*

General Offices: Youngstown, Ohio - District Sales Offices in Principal Cities

SHEETS - STRIP - PLATES - STANDARD PIPE - LINE PIPE - OIL COUNTRY TUBULAR GOODS - CONDUIT AND EMT - MECHANICAL TUBING - COLD FINISHED BARS - HOT ROLLED BARS - BAR SHAPES - WIRE - HOT ROLLED RODS - COKE TIN PLATE - ELECTROLYTIC TIN PLATE - RAILROAD TRACK SPIKES

more than a million!

YARWAY

impulse® steam traps

Starting in 1935, this new idea in steam trapping has earned wide acceptance and approval in practically every industry using steam. More than a million Yarway Impulse Steam Traps have now been sold.

Why? Ask any user. You'll hear reasons like these:

"Quick heating. High, even temperatures"

"Low maintenance"

"Small size, light weight"

"Stainless steel body and working parts"

"Good for all pressures"

"Only one moving part"

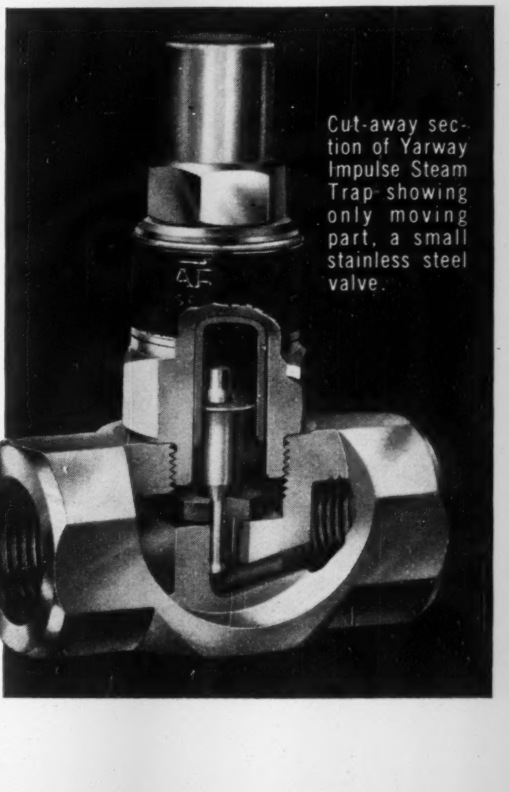
"Low cost"

"Immediate delivery from local distributors"

More than 250 Industrial Distributors in the United States and abroad stock and sell Yarways. Write today for the name of the one nearest you.

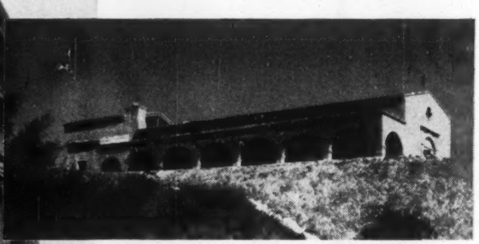
YARNALL-WARING COMPANY
107 Mermaid Ave., Philadelphia 18, Pa.

® *registered*



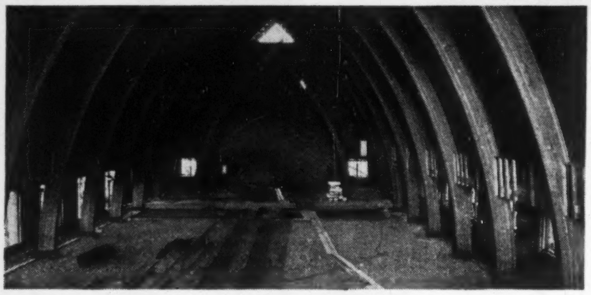
Cut-away section of Yarway Impulse Steam Trap showing only moving part, a small stainless steel valve.

St. Ann's Church
Cleveland Heights, Ohio



The Vivian Webb Chapel, Claremont, Cal.

St. John's Church, Delphos, Ohio



Installation, Church of St. Philip, The Apostle, Clifton, N.J.

Strassbourg Cathedral, 15th Century

BETTMANN ARCHIVE

COMFORT GOES TO CHURCH

Throughout the ages the nobility of man has found no higher expression than in the beauty of the world's churches, temples and cathedrals.

But the majesty of a fifteenth century cathedral, with its lofty spires and delicate filigrees of stone, is no more wondrous than its modern counterpart of perhaps lesser artistry but far greater *comfort* that encourages attendance at worship.

Yes, *comfort* goes to church, now . . . and so do millions more people.

One of the greatest advances in achieving church comfort has been the widespread adoption of radiant heating. For no heating is quite as effective as the gentle, all-permeating, sun-like warmth . . . without drafts, currents, or dead spots . . . achieved by modern radiant heating. Today's church designers know that radiant heating, which assures *utmost* comfort and health protection for both the very young and the elderly groups within congregations, is also ideally suited for every other age of worshippers.

They know, too, that *steel pipe* is the most accepted medium for radiant heating systems . . . in fact, the most widely used pipe in the world for heating, plumbing, snow melting, fire sprinkler systems, and power, steam and air transmission.

Send for your free copy of the 48 page color booklet "Radiant Panel Heating with Steel Pipe" and let comfort go to your church, too.

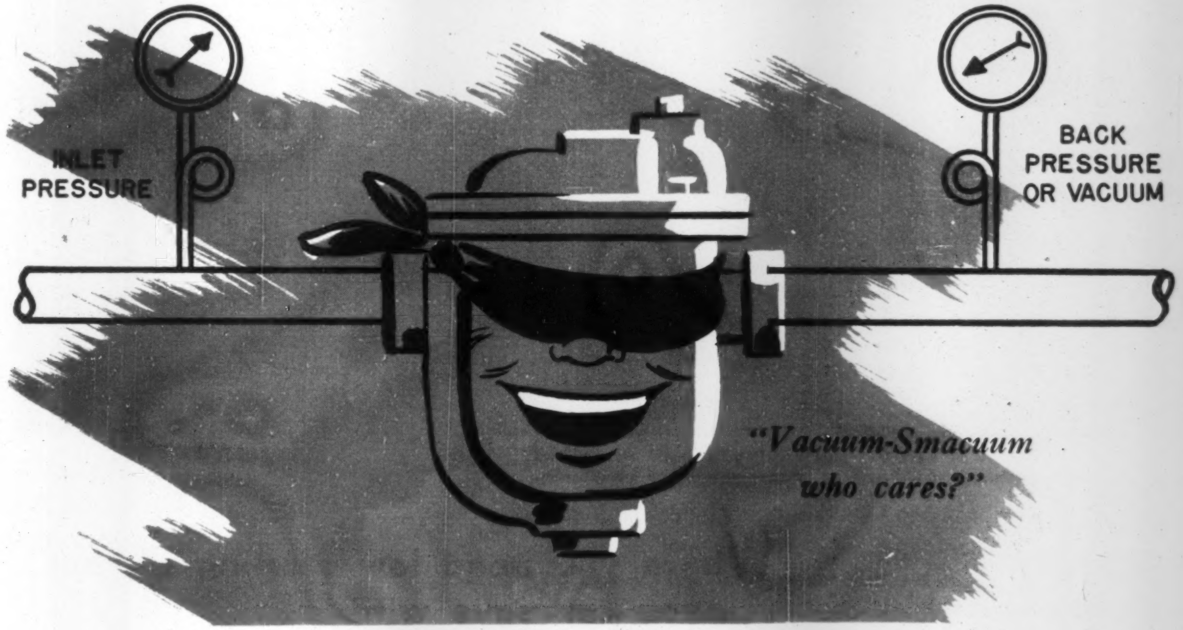
Steel Pipe
is First Choice

Committee on
STEEL PIPE RESEARCH
AMERICAN IRON AND STEEL INSTITUTE
350 FIFTH AVENUE, NEW YORK 1, N. Y.

VACUUM ISN'T VACUUM

TO A STEAM TRAP

...It's Just Pressure Below Atmospheric



ONLY 2½¢ per year per trap parts costs on traps averaging 11 years of service at Globe Steel Tubes Company, Milwaukee, Wisconsin.

PRACTICALLY ZERO maintenance, complete satisfaction with traps after 12 years service on 10 lbs. pressure, 5" vacuum—Liquid Veneer Corp., Buffalo, N.Y.

***Send for 4-page Bulletin No. 223, "Vacuum Isn't Vacuum"—a complete discussion of vacuum, effect on trap selection, causes of vacuum loss, effect of flash steam, etc. Free on request. Just fill in and mail the coupon.**

BUYERS are sometimes told that steam traps for vacuum return service must be "different"—requiring, we suppose, some mysterious ability to recognize vacuum and act accordingly.

The truth is that vacuum isn't vacuum to any steam trap. It is just pressure below atmospheric pressure. All vacuum does is increase the pressure differential across the trap orifice. An Armstrong trap doesn't care whether it discharges to vacuum, back pressure or atmosphere. It works just the same in all cases.

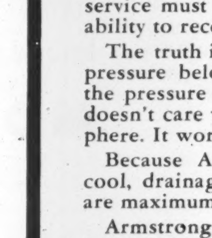
Because Armstrong traps don't have to wait for condensate to cool, drainage is fast and equipment temperatures and BTU output are maximum.

Armstrong traps won't cause you to lose vacuum. Any flash steam from their discharge is quickly condensed. *It is the leaky traps that make it hard to hold vacuum!*

The mechanisms in Armstrong traps for low pressure vacuum return service are identical in design, workmanship and materials to those used in traps for 900°F, 950 lbs. pressure. They can't help but operate a long, long time without leaking. This makes it nice for the maintenance man, too.

Fast heat-up, high temperatures, low maintenance, long life—all wrapped up in one package. Ask your Armstrong Representative to go over your vacuum heating system with you.

ARMSTRONG MACHINE WORKS
874 Maple St., Three Rivers, Michigan



ARMSTRONG MACHINE WORKS
874 Maple St., Three Rivers, Michigan
Please send Bulletin 223, "Vacuum Isn't Vacuum"

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Company________________________

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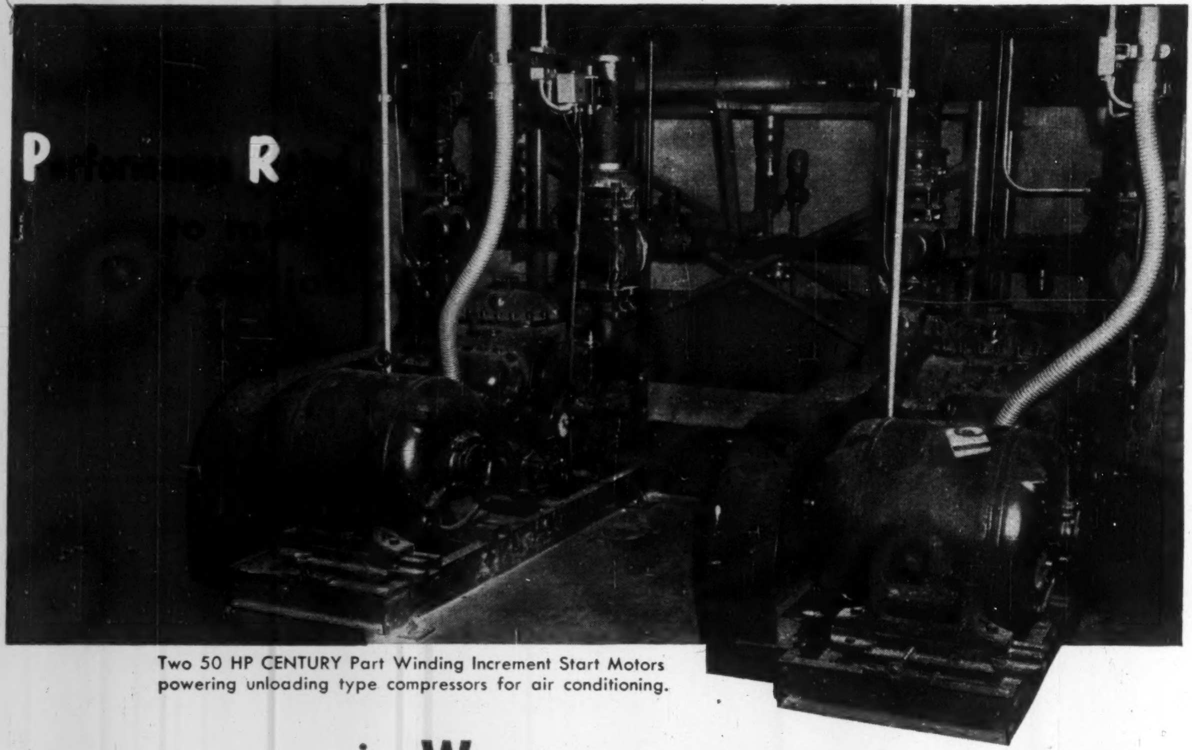
City________________Zone____State________



Two 50 HP CENTURY Part Winding Increment Start Motors powering unloading type compressors for air conditioning.

Here's how part winding increment starting works for you:

Motors of the increment starting type operate by electrically separating the motor winding into two parts. One half the winding operates when starting, delivering roughly half the normal starting torque, drawing about one half the normal starting current. After a few seconds the increment starting control connects the second half of the winding into the circuit delivering full torque and current. The three step starter uses a series resistance to further reduce the current on the first step of the starter.

Where you need low starting current . . . you can save with

Century Part Winding Increment Start MOTORS

Starting large motors where there is a limitation on the amount of starting current may be done easily and inexpensively with CENTURY Part Winding Increment Start Motors and control.

Available from stock in all popular sizes, enclosures, and mountings. 1 to 400 HP polyphase.

- **Drip proof**
- **Splash proof**
- **Dust proof**
- **Explosion proof**

HORIZONTAL OR VERTICAL MOUNTING

Because all popular CENTURY Motors have provisions for part winding increment starting, they are available from stock in the complete Performance Rated Century line.

Write for Bulletin 14-157 P.1, or call your nearby Century Distributor or Century District Sales Office.

Performance Rated©

1/8 to 400 H.P.

Century C MOTORS

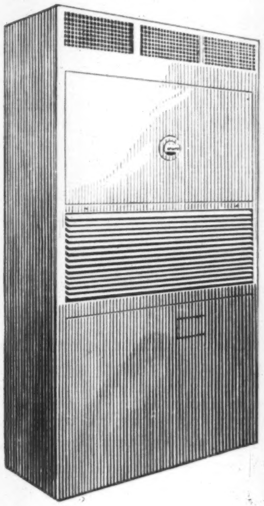
CENTURY ELECTRIC COMPANY

830

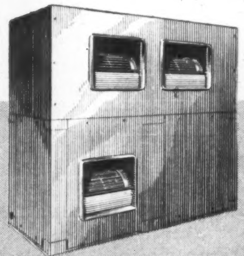
1806 Pine Street • St. Louis 3, Missouri
[illegible] Principal Cities

There's money in the air...
when you sell **CHRYSLER AIRTEMP!**

"Packaged" Water-Cooled Air Conditioners in 6 models, from 2 to 15 H.P.



"Packaged" Waterless Air Conditioners—no water needed, no plumbing required. 2, 3, 5 and 7½ H.P.



do you want to make more profit?

HERE'S HOW TO REDUCE INSTALLATION COST!

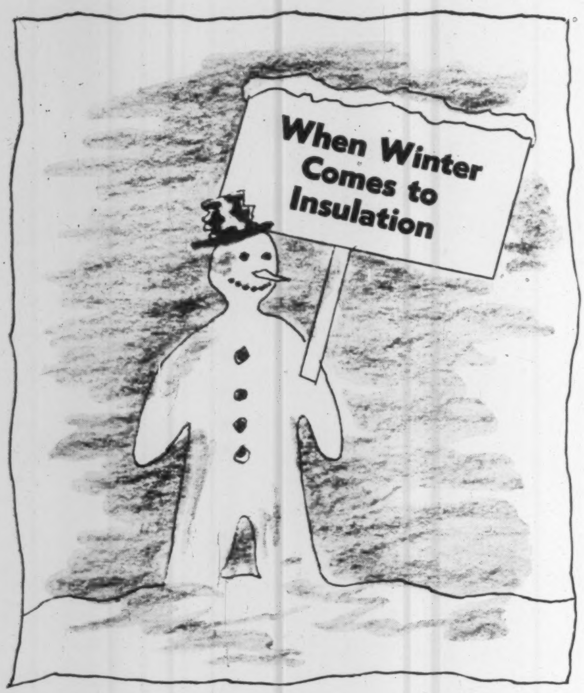
Chrysler Airtemp "Packaged" Air Conditioners are so quiet in operation they can be put in or near the conditioned area—saving ductwork and wiring. You can easily split a unit when need arises. Air-cooled models don't need water savers or plumbing.

Here are factors that make for easier, faster installation—to reduce your costs and increase your profit.
But the Chrysler Airtemp "Packaged" Cooling Franchise is your best choice today for other reasons, too.
Get the complete facts—write Airtemp Division, Chrysler Corporation, Dayton 1, Ohio.

CHRYSLER
AIRTEMP
DIVISION OF CHRYSLER

Air **C**onditioning's
other name ...
Chrysler **A**irtemp

AIR CONDITIONING • HEATING FOR HOMES, BUSINESS AND INDUSTRY


When Winter Comes to Insulation

Summer's not Far Behind!

Insulation for winter warmth and fuel conservation can be more efficient and also provide coolness and comfort in summer. It can reduce original and operating costs of air-cooling equipment as well as heating plants. A building really shielded from the summer sun's radiation is considerably cooler, not only by day, but also at night. Protected against winter heat loss and fuel waste, it warms up faster when there is no great mass of insulating material which also requires heating.

Choosing insulation should be a scientific selection based on physical needs, financial considerations...and performance. Readily available tables show the heat ray absorptivities, reflectivities, and emissivities of the different materials; their permanency, permeability to water vapor, and to what extent they foster or retard destructive condensation. Laboratory reports of the thermal factors should be obtained.

Gold, silver and aluminum sheets have the highest ratings as vapor barriers and reflectors of radiant heat. But aluminum may be had at a very low cost in the form of multiple accordion sheets which automatically create reflective air spaces and surfaces when installed.

Multiple accordion aluminum has high reflectivity (97%) and low emissivity (3%) for heat rays; low conduction because of preponderant air spaces of slight density. Its aluminum and fiber layers retard convection.

The aluminum sheets are long, continuous, and almost impervious to water vapor. Infiltration under flat, stapled flanges is slight. The scientific construction of multiple layers of accordion aluminum, fiber, and air spaces minimizes condensation formation on or within this type of insulation. Its slight mass has little heat storage capacity.

To obtain MAXIMUM, **uniform-depth** protection against heat loss and condensation formation, it is necessary to use the new **edge-to-edge** multiple aluminum*, **each** sheet of which stretches from joist to joist, and also all through the flanges for further vapor protection as well as permanent attachment of each sheet.

Yours for the asking is an illuminating discussion of why and how aluminum insulates, even under extreme conditions. It will be found in the booklet "Thermal Test Coefficients of Aluminum Insulation for Buildings", published by the American Society of Heating & Ventilating Engineers. A free copy, and samples of the new insulation sent by us on request.

*Patent applied for.

COST OF EDGE-TO-EDGE INFRA
Multiple Aluminum Insulation
installed in new construction between
wood joists, material and labor
Type 6-S under 9½¢ sq ft.
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THE EDITORS' PAGES

Merry Christmas

1954 CHRISTMAS GREETINGS 1954

• *Since Christmas seals were first sold in 1907 to raise funds to help a small group of tuberculosis patients, they have been the main support of the voluntary associations, now more than 3000, which support research and treatment of this disease. The campaign has borne fruit; the death rate has been reduced 90 percent. With the National Tuberculosis Association, founded in 1904, HPAC joins in wishing a Merry Christmas and a Happy New Year to all.*

'Spectacular Market' For Air Conditioning

. . . in big building modernization

AIR CONDITIONING of large existing office buildings, hotels and apartments is due for a definite speedup as managements choose between "modernization at a profit and obsolescence at a loss," The Trane Co. predicts.

Big building modernization will create "one of the most spectacular of all marketing opportunities for the air conditioning industry during the next 10 years," said Donald C. Minard, Trane president.

He pictured the "years of vigorous growth" in store for an air conditioning industry that "is hardly in its teens in the life cycle of business," and sketched market after market which holds great sales potentials despite the rapid advances of air conditioning since World War II.

Other fields assuring a flourishing business for the industry:

1) New construction of large buildings. "Today it is virtually unthinkable for anyone to put up a modern hotel or office building without providing air conditioning."

2) New stores and new additions. He cited estimates that "at least 9 out of 10 new stores or additions of any size are being air conditioned."

3) Store modernization. Surveys show 73 percent of the chain stores were still without air conditioning at the end of 1953 despite the fast pace that they have set in all kinds of improvements.

4) Factories. They are increasingly adopting air conditioning to improve or control manufacturing processes. They will, he said, some day be "completely air conditioned to create worker comfort so as to stimulate efficiency and productivity."

Numerous other fields, including schools and industry, were also cited.

Los Angeles Smog Caused By Automobiles?

. . . evidence points that way

LOS ANGELES smog control experts are still pursuing the culprit factors that have caused the increasingly serious smog attacks since World War II. And automobile exhaust appears to be the major cause in the Los Angeles area, an air pollution control expert told the Midwestern Air Pollution association in Chicago last month.

W. L. Faith, deputy director and chief engineer for the Southern California Air Pollution foundation, said there is evidence "that automobile exhaust is the No. 1 culprit in our atmosphere."

He added, however, that "this has not yet been proven to our satisfaction."

Faith said that when evidence first was uncovered that hydrocarbons might be responsible for the eye-stinging smog, control measures were taken and hydrocarbon emissions from oil refineries were reduced.

"But later," he added, "it was found that even larger amounts of hydrocarbons were emitted from the exhaust from automobiles."

He said a report will be completed early next year analyzing the contributions made to Los Angeles smog by hydrocarbons, nitrogen dioxide, carbon monoxide, small particles, sulfur dioxide, and aldehydes.

John E. Brock Becomes Member of Editor Board

. . . has wide piping experience

WE TAKE pleasure in announcing the appointment of John E. Brock to HPAC's board of consulting and contributing editors.

Dr. Brock is Professor of Mechanical Engineering at the U. S. Naval Postgraduate School in Monterey, Calif., having accepted this position recently. Prior to this, he was director of research for the Midwest Piping Co., Inc. He has taught at several universities. He was graduated from Purdue University with a BSME in 1938 and an MSE in 1941. He received the Ph.D. from the University of Minnesota in 1950.

Dr. Brock has written a number of technical articles on the analysis of stresses and reactions resulting from thermal expansion in piping systems that have appeared in HPAC and other technical journals.

Among his HPAC articles is the one in this issue on pages 77-80 entitled *Yes and No, Virginia.*

Also, *The Matrix Method of Making Piping Flexibility* Analyses, July 1952.

Determining Weights of Piping Assemblies, December 1952.

Not So Simple After All, August 1953.

Try These Rules for Easy U Bend Design, to be published.

Dr. Brock is an active member of several committees in groups dealing with piping standards, pipe welding, and testing materials for piping applications.

Construction in 1955 To Top $39 Billion

. . . government predicts

ANOTHER record breaking construction year in 1955 is forecast by the government, with total construction outlays expected to reach $39½ billion, an increase of 7 percent.

This forecast, made by the Departments of Commerce and Labor, is based "on the assumption that the general level of economic activity will remain relatively stable and disposable income — income after taxes — of consumers will continue at a record rate."

Also, the forecast said, "there should be sufficient capital funds available to finance a large volume of construction at comparatively favorable rates, and it is assumed that construction costs will remain relatively stable."

Private spending for new construction is estimated to rise to about $27½ billion, a 7 percent increase over the $25½ billion figure expected for 1954. Government spending for construction is expected to increase by 5 percent to about $12 billion, or $500 million more than for 1954.

The report said the biggest increase will be in non-farm residential building, up 13 percent to $15 billion.

Non- residential building will increase about 4 percent, to nearly $6½ billion.

Almost every category, except outlays for industrial plants, is expected to show an increase. In this category, a decline of 8 percent is predicted.

In line with these predictions, the F. W. Dodge Corp. forecasts an increase of 6 percent in the dollar total of construction for 1955. Thomas S. Holden, vice-chairman of the Dodge Corp., predicts an increase in educational buildings, commercial buildings, hospitals and institutions, public buildings, and social and recreational projects. Alterations, repairs and modernization of existing structures, he said, which in 1954 may have amounted to $1 billion a month, are expected to be at least as large in 1955.

These forecasts indicate a strong upturn in the economic outlook from the moderate opinion which prevailed a few months earlier among 186 of the nation's top economists surveyed by the F. W. Dodge Corp. More than three-fourths of the economists replying expected total activity, measured by gross national product, to be higher in each quarter of 1955. In general, they anticipated a steady rise until the end of the year. However, their prevailing opinion was moderate, with the median forecast for the end of 1955 showing only a 2 percent increase over the level prevailing in the second quarter of 1954, and slightly below the average for 1953.

Annual Directory Section in January HPAC, as Usual

. . . a big editorial job

THE COMPLETE Directory Section of Heating, Piping and Air Conditioning Equipment for Industrial, Commercial, Institutional and Public Buildings — thoroughly revised and brought up-to-date — to appear for the 21st consecutive year in the January HPAC is a big editorial job.

Thousands of listing sheets have been mailed to the manufacturers of the hundreds of items of equipment used in heating, piping and air conditioning installations in plants and big buildings for the latest authoritative information on what will be available where during 1955. The information will be carefully classified for your use, along with the manufacturers' complete street addresses and trade names.

HPAC Show Section Features Big Exposition

. . . in January

ANOTHER SPECIAL FEATURE in the January HPAC will be the special Show Section which will give complete information on the 12th International Heating, Ventilating & Air Conditioning Exposition to be held in Philadelphia in January. It will open on Monday, January 24th at 2:00 p.m. in the Commercial Museum and will close on Friday, January 28th at 6:00 p.m. The Show Section will include a "preview" of all exhibits and the names of those in attendance along with the story and other details of the big show.

The complete program and details of the 61st annual meeting of the American Society of Heating and Ventilating Engineers will also be "previewed" in the Show Section. The meeting will open on Monday and will close on Thursday of the same week.

HPAC Index for 1954 Available on Request

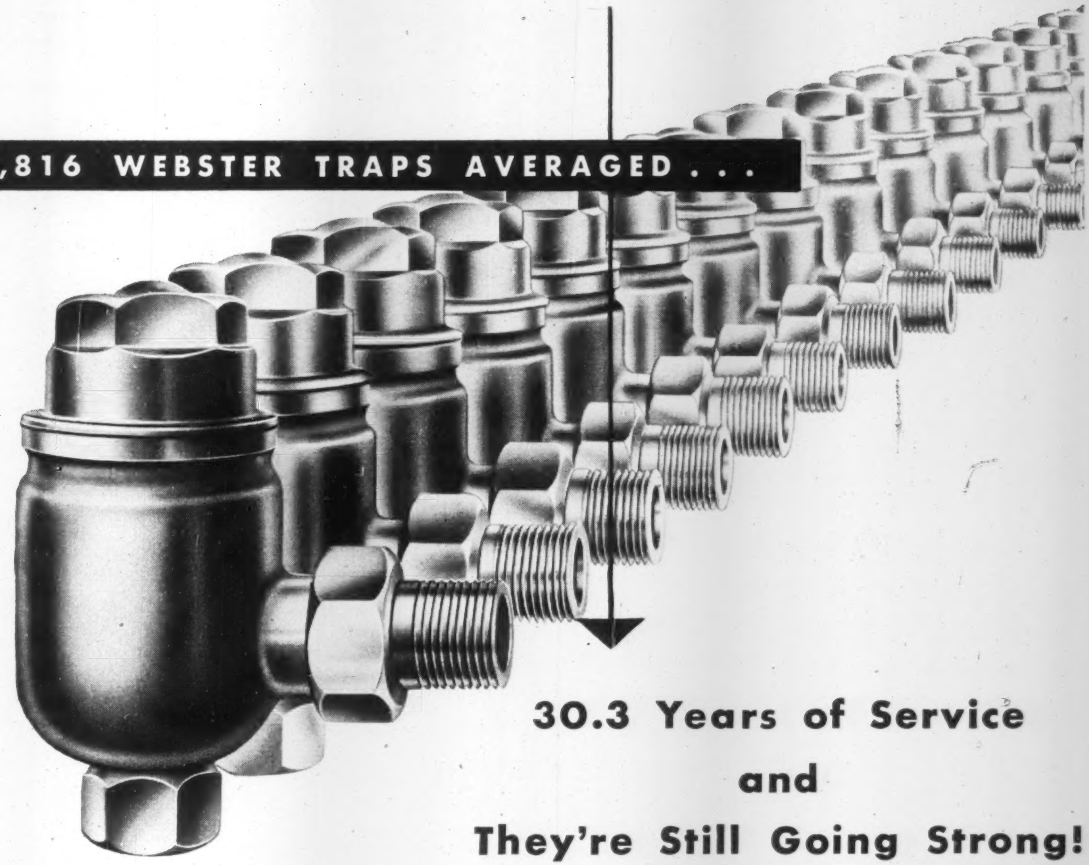
. . . now being compiled

AN INDEX FOR HPAC's 1954 issues, Vol. 26, Nos. 1-12, including the Journal Section of the American Society of Heating and Ventilating Engineers, is being compiled and will be available after the first of the year to HPAC's subscribers on request. If you want a free copy, send a note or postcard to the Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.

We'll keep your request on file until the index has been printed, and will then mail a copy to you.

"Quote"

"In recent years, however, the store fell more and more behind the times. It stayed put while others moved to midtown, it failed to put in moving staircases or air conditioning, it lagged in women's styles." — *From an article in* Business Week, *reporting the planned closing of a large department store.*



51,816 WEBSTER TRAPS AVERAGED . . .

30.3 Years of Service and They're Still Going Strong!

That's what a survey showed – a survey that covered 51,816 Webster Radiator Traps in 16 installations.

Maintenance costs per year per unit – based on the average of 51,816 traps – was 2.8¢. And 20,850 of these traps averaged less than .8¢ per trap – less than a penny a year!

But besides long, trouble-free service and low cost maintenance, Webster Radiator Traps prevent steam loss, and save fuel. Webster Traps hold steam within the radiator or steam-using equipment until it has yielded all its useful heat. And Webster Traps provide continuous, complete, automatic discharge of air and water of condensation.

Even after long years of service, when the traps show signs of wear, Webster Trap Attachments give them new life – bring them up to date quickly, inexpensively, re-using all serviceable parts.

Webster Traps are available in 1/2", 3/4" and 1" sizes and in many body models. Choice of Diaphragm or Sylphon Bellows type.

Before your next trap purchase, get facts and figures from your Webster Representative. He can give you full details of Webster Radiator Traps, Radiator Valves, Float and Thermostatic Traps, Dirt Strainers and other equipment for steam heating or process steam applications.

Address Dept. HP-12

WARREN WEBSTER & CO.
Camden 5, N. J. Representatives in Principal Cities
In Canada, Darling Brothers, Limited, Montreal

-since 1888
Webster
Systems of Steam Heating

Other Webster Heating Equipment includes:

Webster Tru-Perimeter Heating with steam or forced hot water.

Webster Convectors.

Webster Moderator Systems of Steam Heating.

Continuous Flow Controls for hot water heating.

Unit Heaters.

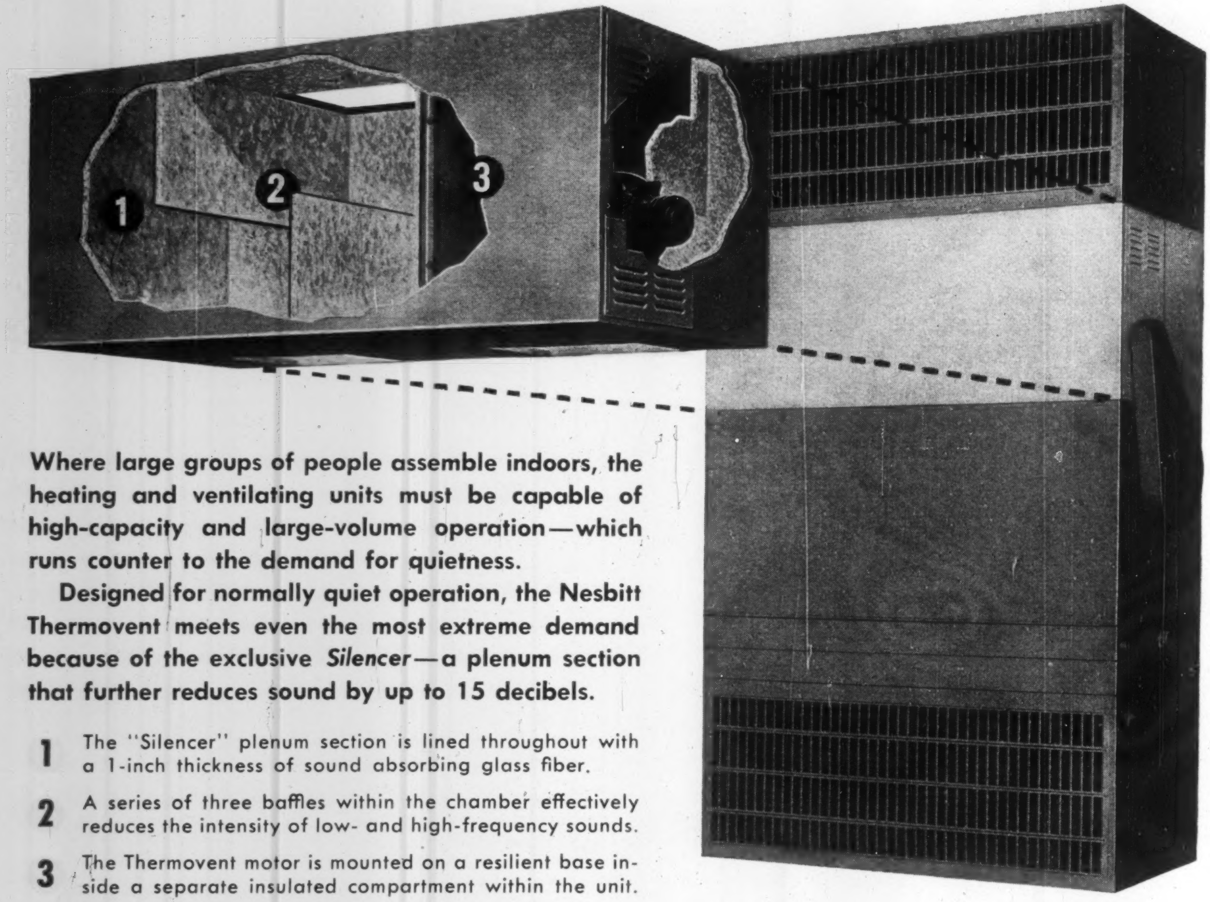
Data on request.

Webster Heating experience includes the field of vacuum, vapor and low pressure steam heating of buildings . . . medium pressure steam in industrial and process heating applications . . . and hot water heating systems for all types of building. Webster's specialized experience is available to you through engineers at the Home Office and through Representatives in 65 cities across the nation.

. . . not first cost but cost per year of service

It *hushes* in a new era of *quiet comfort*

for assembly places where large-volume ventilation is required



Where large groups of people assemble indoors, the heating and ventilating units must be capable of high-capacity and large-volume operation—which runs counter to the demand for quietness.

Designed for normally quiet operation, the Nesbitt Thermovent meets even the most extreme demand because of the exclusive *Silencer*—a plenum section that further reduces sound by up to 15 decibels.

1 The "Silencer" plenum section is lined throughout with a 1-inch thickness of sound absorbing glass fiber.

2 A series of three baffles within the chamber effectively reduces the intensity of low- and high-frequency sounds.

3 The Thermovent motor is mounted on a resilient base inside a separate insulated compartment within the unit.

For achieving and maintaining the desired thermal environment in auditoriums, assembly halls, gymnasiums, cafeterias and similar large spaces, Nesbitt provides the competent, quiet Series T Thermovent.

Thermovent has the quick heating capacity and the adequate ventilating ability demanded by large enclosures. It preserves uniform comfort without drafts even under full occupancy by delivering large volumes of moderate temperature air at low velocity. It introduces a predetermined percentage of outdoor air with low-limit control of the air-stream temperature.

With steam, modulating valves and distributing-tube coils are used. Hot water elements are also offered.

Thermovents are available for vertical, horizontal, or inverted mounting; in nine models of LP units (low pressure, for generally adjacent location) with capacities ranging from 10,000 cfm to 1250 cfm; and seven models of HP units (high pressure, for remote location) with capacities from 15,000 cfm to 3500 cfm.

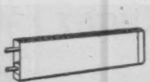
Quiet operation is a Thermovent superlative achieved by experienced design; type of motor, mounting, and placement; type and number of fans with lower speed and discharge velocities; scientific acoustical treatment. Add to these the exclusive Nesbitt *Silencer*, a feature not offered in any other large volume unit ventilator.

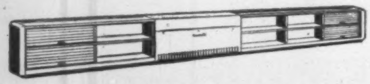
Write for more complete details.

Nesbitt THERMOVENT *with* Silencer

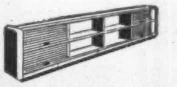
Made and sold by John J. Nesbitt, Inc., Phila. 36, Pa. — Sold also by American Blower Corporation

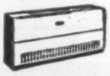
Nesbitt Syncretizer •


Wind-o-line Radiation •


The Nesbitt Package •

Sill-line Radiation •


Sill-line with Cabinets •


Deluxe Cabinet Heater

"OPEN FOR DISCUSSION"

• *WE FOLLOW HERE each month the practice at engineering society meetings of providing an "open for discussion" period. You are urged to take part. Just address your comments to the Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.*

T. L. DAY —

"Why Not Discuss High Pressure Air Systems?"

I FOUND the article, *"Handbook" on High Velocity Air Distribution Design*, by C. Milton Wilson, in the November HPAC, an informative and highly interesting compilation of ideas on high velocity systems.

The distinction between high velocity and high pressure systems referred to in the opening paragraph of the article is a correct one, but I feel that it is misleading to state that "the benefits of the system are entirely from high velocity." The benefits to be derived from use of high pressure systems are certainly an important part of this subject but were not brought out in this article.

There are two principal reasons for using high pressure systems: (1) space saving, as a result of smaller ducts for higher velocities, and facility in crossing under and over obstacles like pipes and beams, and (2) flexibility in volume control. The latter is not possible in low pressure systems, for changes in volume will throw them out of balance.

The degree of unbalance is in direct relation to the ratio of duct resistance to outlet resistance. In low pressure systems, when the duct resistance may be as high as 0.25 in. to 0.50 in. WG, the outlet resistance may be from 0.05 in. to 0.15 in. WG. For a high pressure system with the same duct resistance, the outlet resistance may be from 1.5 in. to 4.0 in. WG. Thus, the amount of unbalance is greatly reduced in a high pressure system when changes in volume are made. Many times, the only reason for using high pressure or medium pressure is this one of flexibility, as in department stores or large offices.

This flexibility due to reserve pressure can be used to advantage for double duct installations also, where this unbalance has been one of the major difficulties encountered when air volumes are varied from one duct to another. If the static pressures in the ducts are reduced to the minimum, as the author suggests, in order to save fan horsepower, this flexibility will be lost. Also, a reserve of static pressure can make up for errors or inaccuracies in duct design. — T. L. DAY, Assistant Chief Engineer, Connor Engineering Corp.

S. W. MILLER —

"Control Manufacturer Should Size Valves"

As HAROLD W. ALYEA points out in his fourth article, *Controlling Unit Ventilators for Steam Systems*, in the January 1954 HPAC, the selection of control valves for unit ventilators is one field in which the traditional conservative design procedure works to a disadvantage. Over-sizing of the steam valve can cause at least as much difficulty in operation as can under-sizing. We are in agreement with the approach outlined by Mr. Alyea for the sizing of these valves, and as a matter of fact have published for several years tables of recommended valve sizes which roughly correspond to those sizes that would be obtained using Mr. Alyea's method outlined here.

Valve size, that is body size, is only a general indication of the capacity of the valve. It has been common practice among control manufacturers to furnish several different ports or plugs for a valve of a given body size, in effect permitting a valve of a given size to have the same capacity as valves of one or two pipe sizes smaller. Such flexibility is necessary, and especially so in the case of specification calling for valve sizes which are too large for accurate control. For this reason, it seems to me that the selection of control valve sizes should be left entirely in the hands of the control manufacturer, to whom it properly belongs, and that the scope of a specification should include only a requirement that the valve furnished, when wide open, shall permit the coil to deliver specified capacity at design steam pressure and entering air temperature. Such a specification would give the control manufacturer the widest possible freedom in selecting his control equipment, and would thus permit him to furnish the exact valve required for the capacity specified, a big step toward attainment of the best possible control available under a given set of conditions.

A word of caution should be given, however. It is possible to go too far in the direction of reducing valve size in order to obtain good control. While piping should ideally be sized for minimum losses, installations often exist in which the pressure drop to equipment located in spaces remote from the boiler room is considerable.

This pressure drop may be as much as 1 or 2 lb. During a cold start under outside conditions approaching maximum load, the boiler may take a period of an hour or more to build up to design steam pressure. Under such conditions of operation with the boiler pressure in the lower part of the design pressure range, the steam pressure available at the control valve in the remotely located space would be quite low, and a valve selected for a pressure drop equal to the average boiler pressure would be under-sized. The heating capacity of the coil would be seriously restricted, and it might be difficult or impossible to bring the space up to temperature in the necessary time. It is suggested that, in specific instances where pressure drops through the piping are large, consideration be given to reducing the design pressure drop through the valve in order to compensate. In other words, that the valve be sized for the full pressure drop available at the space being served. — S. W. Miller, Development Engineer, John J. Nesbitt, Inc.

L. R. FULLER —

"Unit Ventilator Article Helpful"

The Third Article, *Controlling Unit Ventilators on Hot Water Systems,* by Harold W. Alyea, in the December 1953 HPAC, is certainly a helpful one, and we would like to congratulate HPAC on this series. As a unit ventilator manufacturer, we are well aware of the need for more careful selection of valve sizes on hot water and steam ventilator applications.

However, in one section of the article, the author mentions a variable water temperature from 160 F down to 90 F. It is my belief that this water temperature is lower than would normally be found on any school job using forced circulation units such as unit ventilators.

There seems to be a trend toward using higher and higher water temperatures. My point is that I do not believe that the water temperatures as indicated by Mr. Alyea will give sufficiently high temperatures of air to satisfy low limit controllers with water temperatures as low as 90 F. I do not believe that many heating systems will be designed with maximum water temperatures as low as 160 F but, instead, about 200 F to 210 F water.

I was glad to see Mr. Alyea's statement that he feels that a temperature controller, sensing the leaving temperature of the air from the coil, is sufficient freeze-up protection on unit ventilators operating on hot water. We have certainly found this to be the case, for it must be remembered that this temperature controller demanding a 60 F air will require coil surface temperatures 25 F to 30 F higher. It is obvious that with this high a coil surface temperature, freezing conditions cannot result.

Unit ventilator manufacturers and, I would certainly think, installers would prefer an immersion type aquastat in the return connection to the heating coil and the unit ventilator rather than a type of thermostat measuring the actual water temperature within the coil itself. This latter method is cumbersome for the unit ventilator manufacturer because, in most cases, it means special coil construction; and, to the installer, it means locating the proper tube or tubes in the coil for the insertion of this thermostat, of course, it also requires the actual installation of such a thermostat. It has been our experience that the aquastat in the return connection to the coil will give ample protection against sudden drops in water temperature and, because of its ease of installation, we feel it is a preferable method of freeze-up protection. — L. R. Fuller, Manager, Unit Ventilator Dept., The Trane Co.

The Author's Reply — I am in agreement with the points which Mr. Miller and Mr. Fuller bring out and can offer no further comments. — Harold W. Alyea, Chief Field Engineer, Johnson Service Co.

S. A. KULI —

"Boilers Can Be Smaller for HTHW Systems"

I was very pleased by Arthur J. Hess' comments in the June and October HPACs on my articles on high temperature hot water systems, in the January and February 1954 HPACs.

In the February article, under the subtitle, "Selecting the Boilers," I had stated: "In most cases, smaller sized boilers can be used for high temperature hot water heating because of the relatively high heat content of water."

By this I meant that a high temperature hot water heating sysem has a considerably larger volume of water than a steam system of equal capacity. The larger water content can be utilized advantageously for storing heat to satisfy sudden peak loads. In other words, when sizing boilers for a steam heating system, we usually calculate for the highest peak load, whereas in a high temperature hot water system, we don't necessarily size the boilers for the highest peak. The reason why we can specify a smaller boiler than is required for peak loads is that the moderating effect of the large water volume can, in many cases, take care of sudden high heat requirements.

Furthermore, when the water content of the system alone would not be adequate to handle high peaks, we can install a high temperature hot water accumulator to enlarge the system's heat storage capacity. A high temperature hot water accumulator is a simple vessel — usually a vertical storage tank — which is considerably less expensive than a boiler, and in many cases it can substitute for a boiler. I have spelled out a case in my January article where a high temperature hot water accumulator was installed instead of a new boiler for a large sized office building in Germany.

The accumulator is heated up during the night shift when the heating load of the boilers is low, and the stored heat is used for heating the office building during the day shift. The excellent heat storage capacity of HTHW heating systems is the main reason why they, in the majority of cases, use smaller boilers.

An additional, and also important, reason is that the inside surfaces, of HTHW boilers are usually cleaner than those of boilers used for steam heating systems. Evidently, because water losses in HTHW systems are minimal, the same water circulates in the piping system over and over again. Therefore, scale formation and inside corrosion do not reduce the heat transfer rate.

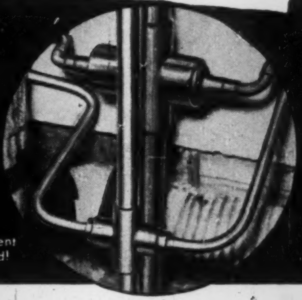
Mr. Hess' comment that the drum of many American commercial boilers would not be adequate to take the expansion of a HTHW system is justified. In such cases, for example, with forced circulation water tube type boilers, an auxiliary tank must often be used as an expansion vessel. For sizing the expansion space, we have to calculate the expansion of water in the entire system, just as in low temperature hot water heating.

There are, however, many other boiler types, the drum size of which is large enough to take the expansion of large heating systems too. — S. A. Kuli, Engineer, American District Steam Co., Inc.

YORK CORPORATION USES *REVERE* COPPER WATER TUBE

...IN AIR CONDITIONING 14 FLOORS OF NETHERLAND PLAZA HOTEL

CINCINNATI, OHIO



ONE OF THE 964 cross connections of Revere Copper Water Tube located in the 18 risers covering 14 floors. 13,000 feet of Revere non-rusting Copper Tube were used, in sizes from 3/8" to 4". Picture, if you will, having to make these connections in these cramped quarters with pipe that couldn't be bent and had to be threaded!

Engineers of the York Corporation told us that they used Revere Copper Water Tube on this job for a number of reasons. Installation of the risers was simplified because no threaded connections were necessary, there were fewer fittings and what few fittings were necessary, were readily soldered. They knew from years of past experience with non-rusting copper that they could count on this "ageless" metal to endure through the years. Also, York Engineers consider copper a natural for air conditioning installations.

In fact, you could almost say, "Where there's air conditioning there's copper." Check the many advantages of copper water tube at right and you'll readily see why.

Keep out of trouble, protect your reputation for quality work, with copper. Use Revere Copper for air conditioning lines, radiant panel heating, hot and cold water lines, underground service lines, waste stack and vent lines, processing lines. See the Revere Distributor nearest you today. And, if you have a technical problem, he will put you in touch with Revere's Technical Advisory Service.

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COPPER AND BRASS INCORPORATED
Founded by Paul Revere in 1801
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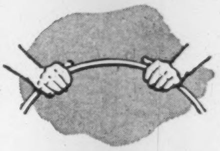
WHY REVERE COPPER WATER TUBE IS PREFERRED FOR AIR CONDITIONING



EASY TO BEND

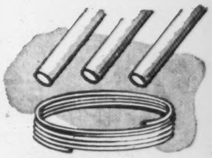
Saves Time

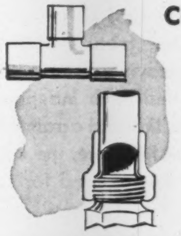
Revere Copper Water Tube is easy to bend. Soft temper can be bent by hand to meet installation conditions.

HANDY LENGTHS

Save Fittings... Labor

Revere Copper Water Tube comes in straight lengths of 20' in hard and soft tempers. 60' coils of soft temper reduce the number of fittings needed.





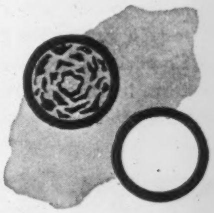
SOLDER OR COMPRESSION FITTINGS

Need Less Work Room ... Save Metal

No worry about wrench room when you use Revere Copper Water Tube with solder fittings. Compression fittings can also be used. No threading is necessary with either type fitting. Wall thickness of tube used can thus be less than for threaded pipe.

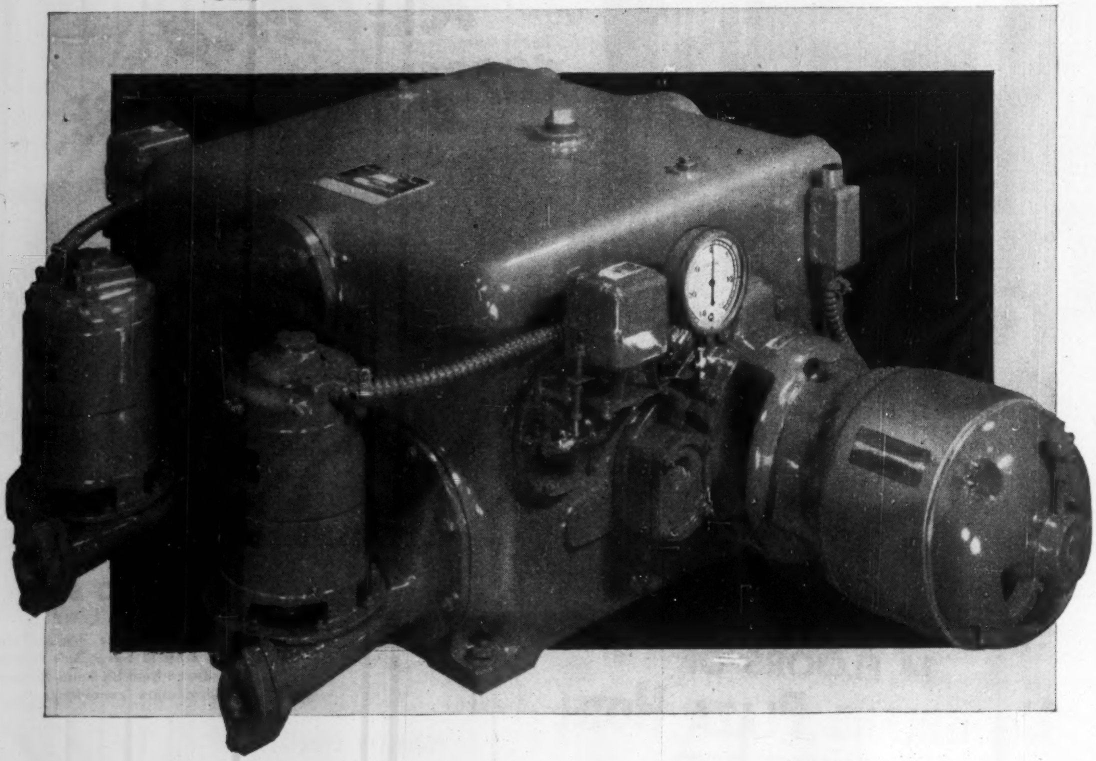
NON-RUSTING

Rustable pipe eventually clogs as shown in drawing at top right. Non-rustable Revere Copper Water Tube suffers no loss of flow or pressure as shown at bottom right. No allowance in pipe size need be made for rust accumulation with Revere Copper Water Tube.



THIS NEW VACUUM HEATING PUMP

HAS THE INCREASED AIR CAPACITY EFFICIENT HEATING PRACTICE DEMANDS



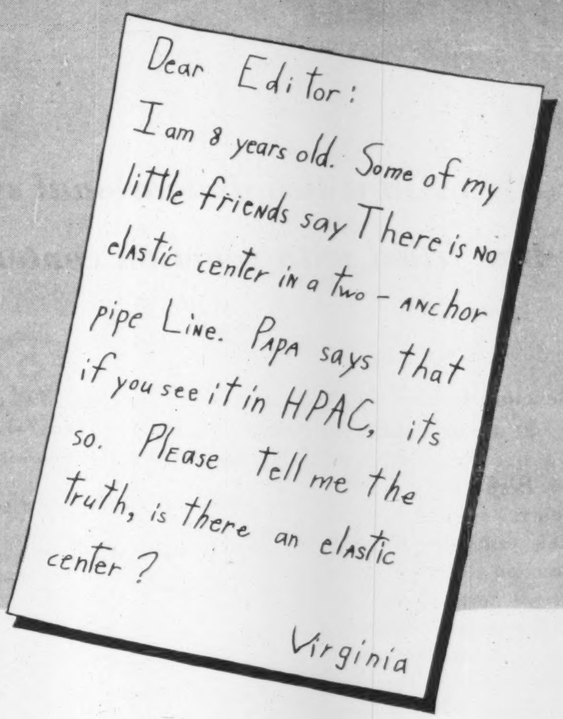
It's the Nash CSM

Designed and manufactured by the organization that made the Jennings Manifold Heating Pump standard of the Heating Industry, the new CSM incorporates every desirable feature architects, engineers, owners and operators have sought. Employing separate air and water pump elements, each with its own motor and each independently controlled by its own automatic switch, the capacities and arrangement may be widely varied to meet job conditions. For the first time, the engineer has the choice of realistic water and air capacities required for rapid system response without wasteful overheating.

These pumps possess many other features which permit a more efficient utilization of fuel and minimum use of electric power. Low, low returns reduce installation costs and usually eliminate putting the pump in a pit. Simplicity and efficient operation reduce supervision and maintenance costs. Information regarding this new heating pump development is available immediately upon request.

- ✓ **Increased air capacity induces rapid system response without wasteful overheating.**
- ✓ **Separate air and water pumps individually selected to meet actual job requirements.**
- ✓ **Control system that operates individual pumps only when needed.**
- ✓ **Flexibility permitting addition of radiation without changing basic pump installation.**
- ✓ **Low, low, return line connection.**

NASH ENGINEERING COMPANY
437 WILSON, SO. NORWALK, CONN.



Dear Editor:
I am 8 years old. Some of my
little friends say There is NO
elastic center in a two - anchor
pipe Line. PAPA says that
if you see it in HPAC, its
so. PlEase tell me the
truth, is there an elastic
center?

Virginia

One of the most popular Christmas stories is about a little girl, Virginia, who wrote to the editor of a big metropolitan newspaper asking if there is a Santa Claus. His published reply in the form of a letter has become something of a classic.

Just for fun — with Christmas almost here — the author uses the "Dear Virginia" form for this article on piping.

Yes — and No, Virginia

. . . sometimes there is — and sometimes there isn't — a point in a piping system through which thermal reactions may be considered to act

By John E. Brock
Professor of Mechanical Engineering
U. S. Naval Postgraduate School

(Editor's note: We suspect that "Virginia" is neither Virginia nor eight years old, but the question "she" asks is one that has confused many piping engineers, including some who have made valuable contributions to the science — or art — of piping stress analysis. We have asked Dr. John E. Brock, Professor of Mechanical Engineering at the U. S. Naval Postgraduate School, Monterey, Calif., and formerly Director of Research for the Midwest Piping Co., Inc., to answer Virginia's letter. Professor Brock is a member of HPAC's board of consulting and contributing editors.)

DEAR VIRGINIA — Your little friends are wrong. We can easily write some conditions defining an elastic center, viz.:

$$x_1 = \int (k/EI)x\,ds / \int (k/EI)\,ds \quad \text{[1]}$$

$$y_1 = \int (k/EI)y\,ds / \int (k/EI)\,ds \quad \text{[2]}$$

$$z_1 = \int (k/EI)z\,ds / \int (k/EI)\,ds \quad \text{[3]}$$

and there we have it! The quantities x_1, y_1 and z_1 are the coordinates of the elastic center, and although it may involve some labor, these quantities may be evaluated and the spot located so that you can put your finger on it.

Yes, Virginia, there is an elastic center. But as you see, this assertion is trivial in itself. It is simply a matter of definition. The real question your little friends had in mind concerns whether the elastic center defined by Equations 1, 2, and 3 — or, for that matter, by any such set of equations — possesses the useful properties generally attributed to it.

> ***" . . . In a two dimensional system there is a straight line filled with reaction centers . . . "***

Is There a Reaction Center?

Accordingly, let us examine, for the moment, a question similar to the one you ask. Here it is:

Is there a point — which for the purposes of this discussion we will call, say, a "reaction center" — such that the reactions imposed on (or by) a two-anchor piping configuration as a result of thermal expansion and/or cold spring may be regarded as a single resultant force passing through this point?

We will show that there is no such thing as a reaction center in the case of a three dimensional configuration or even in the case of a two dimensional configuration in which the end points experience a relative displacement perpendicular to the plane of the configuration.

However, as we will show, in the case of a strictly two dimensional system, there is such a reaction center; in fact, a whole straight line filled with them. It happens that the elastic center defined by Equations 1 and 2 — but not 3 — lies on this line, or in other words, the elastic center in a strictly two dimensional case is also a reaction center. We will show these things in two ways, first analytically for those who prefer such an approach, and second geometrically for those who prefer to think in geometrical terms.

Fig. 1 shows a piping configuration in space. We are concerned with the reactive force components F_x, F_y, and F_z and the reactive moment components M_x, M_y and M_z which are applied to the end of the pipe at point O. It may be convenient to think of these reactions as being applied by means of the rigid lever OP, the forces and moments at point P being distinguished by asterisks. Application of the principles of elementary statics to the free body shown in Fig. 2 provides the following relations:

$$F_x{}^* = F_x;\ F_y{}^* = F_y;\ F_z{}^* = F_z; \quad \ldots\ldots\ldots\ldots [4a,b,c]$$

$$M_x{}^* = M_x + zF_y - yF_z \quad \ldots\ldots\ldots\ldots [5]$$

$$M_y{}^* = M_y + xF_z - zF_x \quad \ldots\ldots\ldots\ldots [6]$$

$$M_z{}^* = M_z + yF_x - xF_y \quad \ldots\ldots\ldots\ldots [7]$$

Clearly, nothing can be done to alter the reactive forces at point P, but by a suitable choice of point P itself, that is, by a suitable choice of coordinates x, y, and z in Fig. 1, we may be able to simplify the resulting reactive moment at P. If we denote this resultant moment by $M_R{}^*$, we have

$$M_R{}^* = \sqrt{(M_x{}^*)^2 + (M_y{}^*)^2 + (M_z{}^*)^2} \quad \text{--------} [8]$$

For convenience, we will use the following abbreviations:

$$R = \sqrt{(F_x)^2 + (F_y)^2 + (F_z)^2} \quad \text{------------} [9]$$

$$S = F_xM_x + F_yM_y + F_zM_z \quad \ldots\ldots\ldots\ldots [10]$$

Now multiply out the quantity $R^2(M_R{}^*)^2$. A large number of terms are involved, but by grouping and factoring, the following form may be obtained.

$$\begin{aligned} R^2\ (M_R{}^*)^2 = S^2 &+ [(F_zM_y - F_yM_z) + x(F_y{}^2 + F_z{}^2) - yF_yF_x - zF_zF_x]^2 \\ &+ [(F_xM_z - F_zM_x) - xF_xF_y + y(F_z{}^2 + F_x{}^2) - zF_zF_y]^2 \\ &+ [(F_yM_x - F_xM_y) - xF_xF_z - yF_yF_z + z(F_x{}^2 + F_y{}^2)]^2 \quad ..[11] \end{aligned}$$

This is certainly not an obvious relation. However, it may be checked with no difficulty — but much labor — by expanding both sides of the equation, using Equations 5 through 10, and comparing term for term.

Equation Eleven Is Instructive

Equation 11 is very instructive. It consists of the sum of four squares and each of these must be positive or zero. The first term, S^2, does not depend upon the coordinates of point P. Therefore, even if we are successful in finding a point P for which the other three squares all become zero (and we will show that this can be done), we will still have $R^2(M_R{}^*)^2 = S^2$. In other words, for all possible choices of point P, we see that

$$M_R{}^* \geqq \frac{F_xM_x + F_yM_y + F_zM_z}{\sqrt{(F_x)^2 + (F_y)^2 + (F_z)^2}} = \frac{S}{R} \quad \text{----} [12]$$

Now, if x, y, and z are chosen so that

$$yF_z - zF_y = M_x - F_xS/R^2, \quad \ldots\ldots\ldots\ldots [13]$$

$$zF_x - xF_z = M_y - F_yS/R^2, \quad \ldots\ldots\ldots\ldots [14]$$

$$xF_y - yF_x = M_z - F_zS/R^2, \quad \ldots\ldots\ldots\ldots [15]$$

it is easy to see from Equations 5, 6, and 7 that

$$M_x{}^* = F_xS/R^2 \ldots\ldots\ldots\ldots [16]$$

$$M_y{}^* = F_yS/R^2 \ldots\ldots\ldots\ldots [17]$$

$$M_z{}^* = F_zS/R^2 \ldots\ldots\ldots\ldots [18]$$

so that

$$M_R{}^* \geqq \frac{F_xM_x + F_yM_y + F_zM_z}{\sqrt{(F_x)^2 + (F_y)^2 + (F_z)^2}} = \frac{S}{R} \quad \text{----} [19]$$

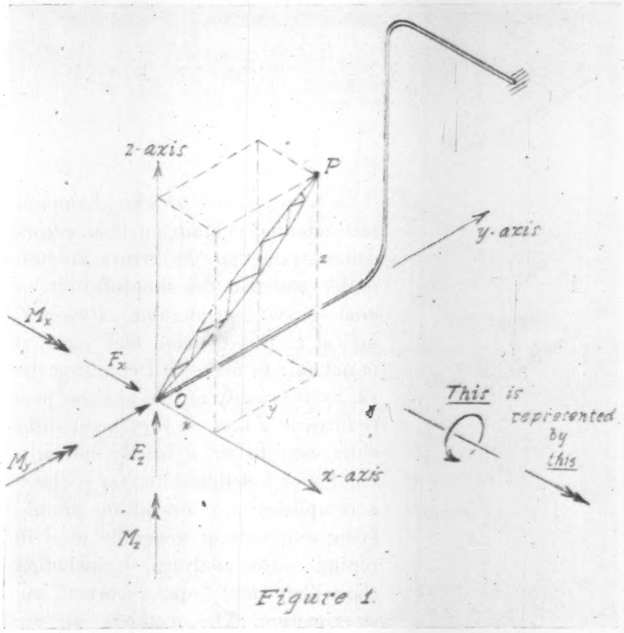
which is its minimum possible value. Thus, if Equations 13, 14, and 15 are satisfied, the last three square terms in Equation 11 must be zero.

Now, supposing that F_z is not equal to zero, the choices

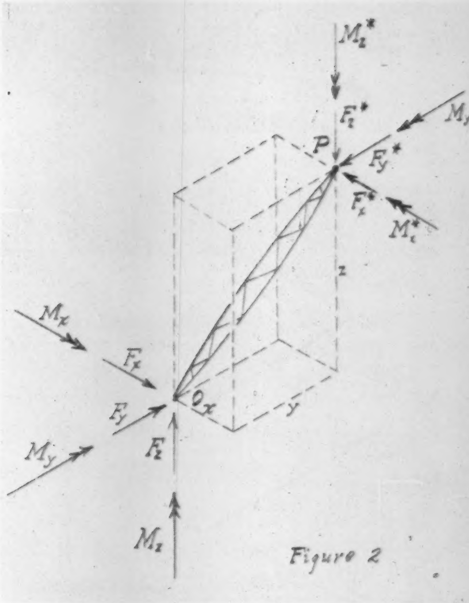
$$x = (zF_x - M_y + SF_y/R^2)/F_z \quad .[20]$$

$$y = (zF_y + M_x - SF_x/R^2)/F_z \quad .[21]$$

clearly satisfy Equations 13 and 14, no matter what value z may have, and a little algebraic manipulation shows that these same values also satisfy Equation 15. Thus, there is a whole line full of points P for which $M_R{}^*$ assumes its minimum values S/R. (If $F_z = 0$, the preceding development breaks down, but in this



1 IN THIS PIPING CONFIGURATION in space, we are concerned with the reactive force components F_x, F_y and F_z and the reactive moment components M_x, M_y and M_z which are applied to the end of the pipe at the point O



2 LET US THINK OF THESE REACTIONS as being applied by means of the rigid lever OP, the forces and moments at point P being distinguished by asterisks

case, an even simpler proof can be constructed.) However, for no point does $M_R{}^*$ become less than a certain minimum value, except in the exceptional case that S happens to be zero itself. In other words, there is no reaction center.

Now let us see what the situation is in a strictly two dimensional case for which $M_x = 0$, $M_y = 0$, and $F_z = 0$. First, we see that $S = 0$ so that by a suitable choice of x, y, and z, we can indeed make $M_R{}^* = 0$. Choose $z = 0$, and let P be any point along the line

$$y = (xF_y - M_z)/F_x \quad ....[22]$$

With this choice, the moment actually is zero and the resultant force system does indeed consist merely of a resultant force R acting along the line described by Equation 22. That is, any point P on this line is a reaction center.

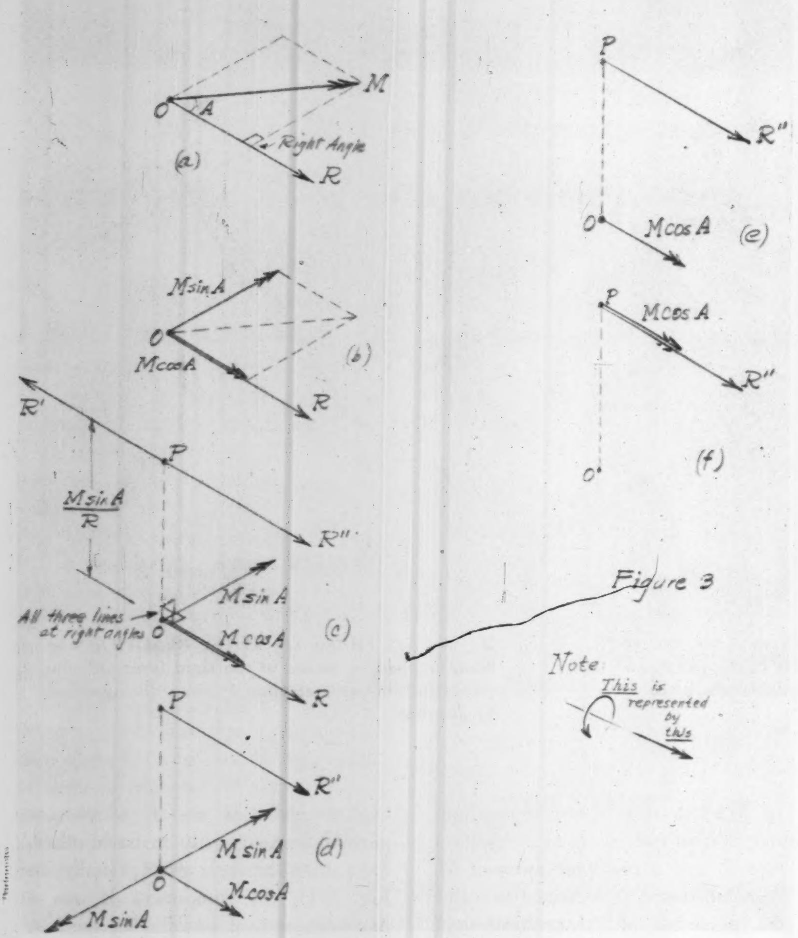
Consider the Geometry

Next, we consider the geometrical demonstration promised earlier. In Fig. 3(a) there is shown a resultant force system consisting of a resultant force R and a resultant moment M. We recall that R is localized in a line (the principle of "transmissibility" which says that a force-vector is a "line-vector" or a "sliding-vector"), whereas M (a polar vector) is constrained only in direction. Putting their initial points both at point O, the two vectors determine a plane and there is an angle A between them. In Fig. 3(b), the moment M has been broken up into two components, one, M cos A, along R, and the other, M sin A, perpendicular to R. In Fig. 3(c), two forces R' and R'' have been added. These are each equal in magnitude to R and parallel to R, but being opposed to each other and along the same line, annul one another, so that they can be added to our force system without altering it. They are added parallel to R at a distance (M sin A)/R perpendicular to the plane of M and R. In Fig. 3(d), forces R and R' have been replaced by the moment M sin A, directed as shown, which they constitute. In Fig. 3(e), the two moments M sin A, which are parallel and opposite to each other, have annulled each other. Finally, in Fig. 3(f), the component M cos A has been moved parallel to itself so as to lie along R''. This simplified force system is called a "wrench"; it cannot be reduced further. The moment component which remains, namely, M cos A, is the same as the quantity S which was employed in the analytical discussion.

However, in a strictly two dimensional system, the original moment M could have no component lying in the plane of the forces. In such a case, $A = 90$ deg and M cos $A = 0$. Thus, the line along which R'' acts is a line full of reaction centers.

Here's the Answer, Virginia

Now, Virginia, what can all this be boiled down to? Simply this: in other than a strictly two dimensional system, to say that the elastic center defined by Equations 1, 2, and 3 — or by any other equations — possesses the properties of a reaction



3 NEXT, LET US CONSIDER THE GEOMETRICAL demonstration of these reactive moment components

center (as we have defined the term) is to do violence to the basic principles of statics — and when you do this, you are bound to get errors in your results.

It is very easy to demand that those who propose or who champion methods that contain intrinsic errors demonstrate that the errors are tolerable and that the simplification in analysis is considerable. However, logical as this demand may seem, it is not fair to make it. Delimiting the range of validity of one of these procedures is a task of very great difficulty, and, to put it briefly, no satisfactory such delimitation has yet been accomplished for any of the simplifying assumptions generally used in piping stress analysis — including the widely used "square corner" approximation. The methods we are discussing have undoubtedly proved useful in spite of their errors and so far as the writer is aware, there has never been a case of physical malfunction attributable to thermal expansion in a system analyzed and found satisfactory by such methods. On the other hand, it is possible to make up examples of a practical nature in which the errors due to such an approximate analysis would appear to be utterly intolerable. Possibly this can be accounted for by the fact that a good analyst must be able to sense trouble and apply theoretically precise methods in cases of doubt.

Gas Supply Adequate for 150 to 200 Years

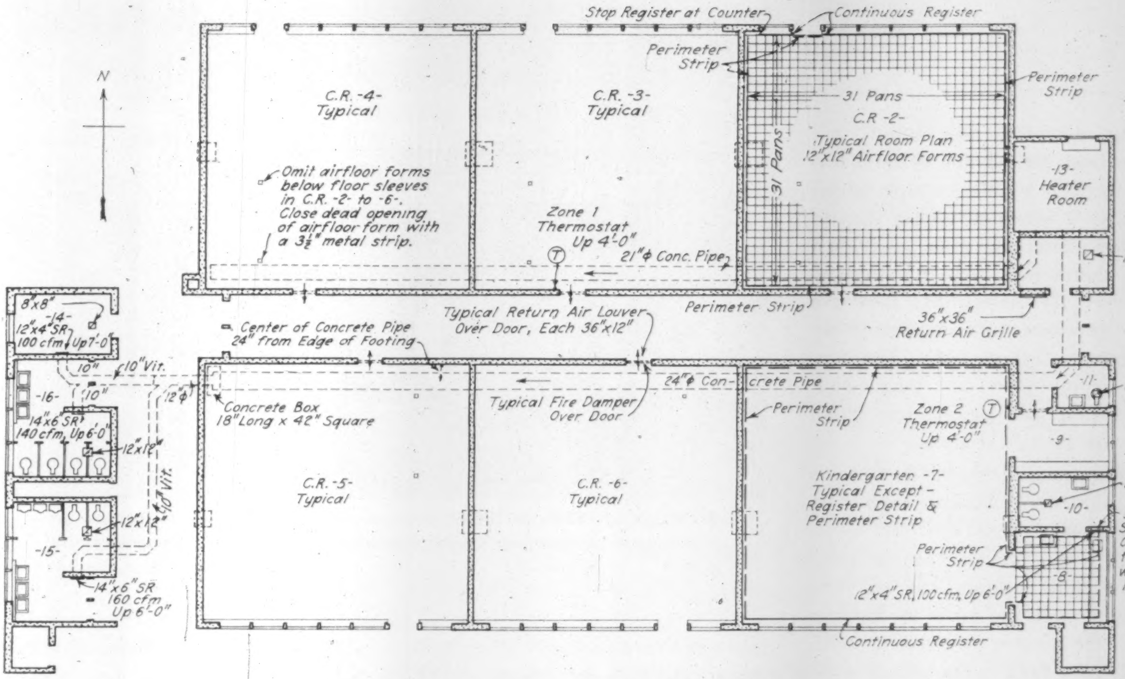
AN ADEQUATE GAS SUPPLY for the next 150 to 200 years is insured in the U. S., as a result of the development of natural gas substitutes, according to Capt. E. S. Pettyjohn, vice president and director of the Institute of Gas Technology, Illinois Institute of Technology, Chicago.

Speaking at the 13th annual meeting of the Gas Institute, Capt. Pettyjohn said the gas industry can look forward to an enduring and productive future although the natural gas supply is not unlimited. He pointed out that the Institute — the gas industry's own educational and research facility — in recent years has developed processes for the production of natural gas substitutes from coal, natural gas condensates, and petroleum.

"The complete gasification of coal will insure an unlimited gas supply for the foreseeable future," Capt. Pettyjohn declared. "The Institute already has developed a process of gasification of coal without coke, tar, or other byproducts."

Of all gas making materials, he explained, coal is in the greatest abundance, and thus will provide an unlimited source of gasification.

Performance and development tests are being conducted in the Institute's utilization laboratories which are available not only to utilities, but particularly to equipment manufacturers and all commercial and industrial users of gas as fuel.


N
Stop Register at Counter
Continuous Register
Perimeter Strip
Perimeter Strip
31 Pans
31 Pans
C.R. -2-
Typical Room Plan
12"x12" Airfloor Forms
C.R. -4-
Typical
C.R. -3-
Typical
Omit airfloor forms below floor sleeves in C.R. -2- to -6-. Close dead opening of airfloor form with a 3½" metal strip.
Zone 1
Thermostat
Up 4'-0"
21"φ Conc. Pipe
-13-
Heater Room
12"x12"
8"x8"
-14-
12"x4" SR
100 cfm, Up 7'-0"
10"
10" Vit.
10"
12"φ
-16-
14"x6" SR
140 cfm, Up 6'-0"
12"x12"
10" Vit.
12"x12"
-15-
14"x6" SR
160 cfm
Up 6'-0"
Center of Concrete Pipe 24" from Edge of Footing
Typical Return Air Louver Over Door, Each 36"x12"
Perimeter Strip
36"x36"
Return Air Grille
24"φ Concrete Pipe
Concrete Box
18" Long x 42" Square
Typical Fire Damper Over Door
Perimeter Strip
Zone 2
Thermostat
Up 4'-0"
-11-
8"x8"
-9-
C.R. -5-
Typical
C.R. -6-
Typical
Kindergarten -7-
Typical Except - Register Detail & Perimeter Strip
8"x8"
-10-
3¼"x12"
Stack Head Connected to Airform with Sheet Metal
Perimeter Strip
-8-
12"x4" SR, 100 cfm, Up 6'-0"
Continuous Register

1 CENTRAL HEATER ROOM, upper right, serves all six classrooms. From two concrete main supply ducts air passes through floor cavities to outside continuous registers

Warm Air Floor Panel–Convection Combined To Heat New School

• Students are not the only ones who face problems and new ideas in the modern school. The ingenuity of engineers and contractors also is challenged. Evidence that they are keeping pace in meeting the changing requirements of today's educational plants is reflected in several articles published recently in HPAC and planned for future issues. Here is one about a unique heating system utilizing warm air to heat a concrete slab floor and to provide convection heat as well as ventilation from continuous baseboard registers.

By G. L. Gendler

Consulting Engineer;
Lecturer in Architectural Mechanics
University of California

A WARM AIR FLOOR PANEL heating system is installed in the Alta Heights school, Napa, Calif., and provides the advantages of a comfortably warm slab and outdoor air for ventilation. The system was installed without increasing the total cost of construction.

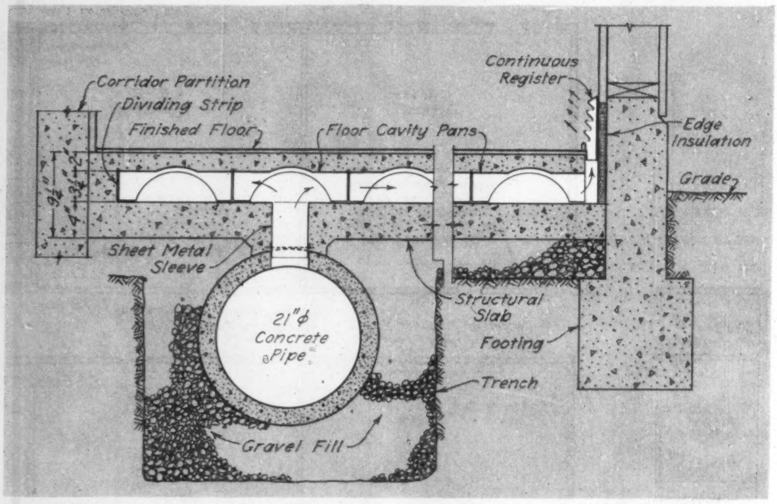
The floor plan of six classrooms, three on either side of an enclosed corridor, with a central heater room at one end, is shown in Fig. 1. Two counterflow furnaces are installed on concrete discharge plenum chambers. Supply and return air are controlled at the blower intake by motorized mixing dampers. The supply air passes from the plenum of each furnace through a concrete pipe, which serves as a warm air supply duct to the three-classroom zone. Individual room thermostats were not deemed necessary for rooms that have the same exposure and approximately equal internal heat loads. The concrete supply pipes are tongue-and-groove pipe, and are not reinforced. They are in 3 ft sections.

The warm air from the duct passes up into the cavity floor through sheet metal sleeves. (See Fig. 2) These holes are 3 ft on center at the joint of each pipe section. The air then passes through the warm air cavities from the inside classroom wall, through the floor to the outside wall, warming the floor uniformly as it passes along and then passes up through a continuous register at the outside wall. The air enters the room at low velocity and counteracts the cold wall effect and downdrafts at the outside window walls. The air is then returned to the central corridor through louvers above the doors in each classroom and into a single return air intake that is adjacent to the heater room.

The air supply to the kindergarten passes through an air slot behind the cabinets to the same type of continuous register as used at the baseboard. These special registers have interlocking blades and are vision-proof to prevent the students from poking pencils and other objects into the outlets. The air supply to the toilet spaces is extended from the end of the concrete pipe into sheet metal stacks and highwall registers. The air is not recirculated from the toilets, which are, in effect, separate from the classroom wing.

How System Was Installed

A novel feature of the cavity floor system is the fact that the entire floor structure itself is an integral part of the heating system which conserves space and reduces construction costs. Space conservation is two-fold: (1) Furred-in overhead ductwork is virtually eliminated. Only short return and outdoor air sheet metal duct connections are required at the furnace room. (2) Heater room space is kept to a minimum by the use of counterflow furnaces.



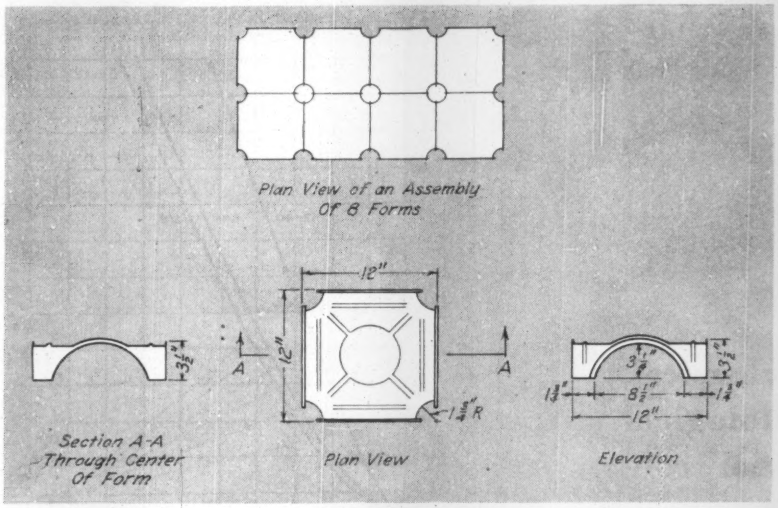
2 TYPICAL FLOOR SECTION shows metal sleeve, which delivers air from supply pipe to floor cavity, and other details. Mean floor temperature is 75 F

The system incorporates prefabricated sheet metal forms installed in a double deck floor construction consisting of two relatively thin, monolithic concrete slabs. The slabs are separated by means of a mushroom column formation within the entire floor area that creates a catacombed air space through which warm or tempered air can be circulated. The forms are specially designed, 26 gage metal stampings, 12 in. square and 3¼ in. high. The top of the form is slightly domed for additional rigidity, and the matching faces are flanged with small ears, which are bent over a metal clip for holding the forms together to form a tight-fitting deck over the structural slab.

A 4 in. structural reinforced slab was laid over the rock fill and rough-finished. Reinforcement was placed in the lower slab only, since tensile stress was caused by a positive bending moment. The plugs were removed from the sleeves in the supply ducts and the steel cavity forms were laid starting at the outside wall. Forms were shop-assembled in units of eight and delivered to the site, and these assemblies were then locked together in position on the lower slab. (See Fig. 3.) A 3½ in. high x 26 gage perimeter strip closes the ends of the forms on all sides except at the register.

The direction of air flow through the forms is determined in the design, so that the warmest air will travel to the zones of the greatest heat loss. The direction of the air flow can be permanently set by installing dividing strips between the stampings before the top layer of concrete is poured.

The finished layer of concrete was poured over the forms with a minimum thickness of 1½ in. above the arch crown. This results in a self-supporting upper slab forming arches and groins. The units are 12 in. on centers in rows and are at right angles to each other. The center point between any four units makes a groin. About 90 percent of the floor area between slabs is air space, which stops capillary action of moisture through the slab. Heat loss through the edge of the slab was minimized by installing ⅝ in. edge insulation behind the registers against the outside wall. Classroom floors are finished with asphalt tile.


Plan View of an Assembly Of 8 Forms
12"
12"
3½"
A
A
1¾" R
3⅛"
3½"
1¾"
8½"
1¾"
12"
Section A-A Through Center Of Form
Plan View
Elevation

3 STEEL FORMS, 12 in. square and shop-assembled in units of eight, are locked together in position on the lower slab. Upper slab is self-supporting by means of arches and groins

Controls Are Automatic, Zoned

The system is fully automatic and is controlled by zone thermostats, with summer switches for independent blower operation for ventilation and cooling with outdoor air during mild weather—60 F or above.

The outdoor air dampers are positioned to supply a minimum of 10 cfm of outside air per student at all times for the control of odors and a comfortable learning atmosphere. The outdoor air damper will be full open when the return air is at 70 F or above. Each of the two-zone thermostats cycles the gas valve on the furnace to maintain the room temperature. The control point of the room thermostat is re-set by an outdoor temperature controller. A time switch provides program control to the supply fans so that the system will operate as required during the school day. The outdoor air and return air passes through cleanable filters. The furnace is equipped with a manual bypass damper to handle the required air quantities and, at the same time, produce a minimum temperature rise of 70 F through the combustion chamber.

Dampers are not required in the supply system, since the ducts act as a static pressure plenum chamber. In the event that any air balancing should become necessary, the openings from the slab into the registers can easily be adjusted.

Cost of installation of this type of system is subject to numerous variables depending upon the location, overall project size, type of construction, type of heating medium and the competition at the time of bidding. The cost of this installation was approximately the same as that of a quality hot water floor panel system with individual room control. The heating contract cost included the forms, registers, heating equipment and controls, perimeter insulation, trenching for concrete ducts and all under-floor concrete work except the two slabs.

Proper air delivery is the key factor in obtaining maximum uniformity in floor and room air temperatures. The frequent air changes have the secondary effect of providing a comfortable classroom atmosphere. The air should be returned either at the high wall or ceiling in order to maintain uniform floor-to-ceiling temperatures. Room air temperature lag is prevented by the use of the warm air panel and convection split system and the inherent ability of heating by convection to follow the need for heat. The frequent air change results in a fast pick-up or reduction of room temperature as required.

The over-riding effect which may be encountered when the outdoor temperature rises rapidly, as it does in many California communities, together with the sun load and lighting loads, is virtually eliminated in the warm air panel system by continuous blower operation, in conjunction with automatic outdoor air damper control.

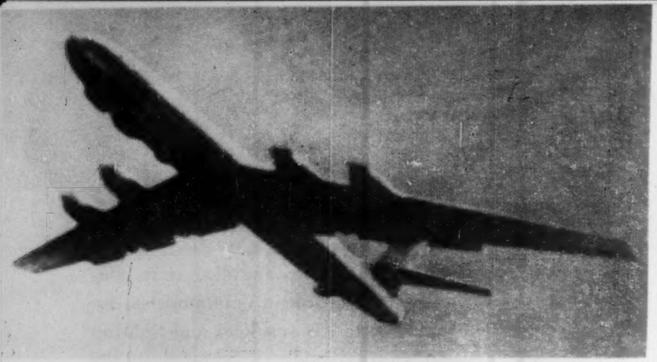
How System Operates

The mean floor temperature is maintained at approximately 75 F at design conditions. It is estimated that 30 to 40 percent of the heating is accomplished by radiation and convection from the floor slab and 60 to 70 percent by convection from the air entering the room from the registers.

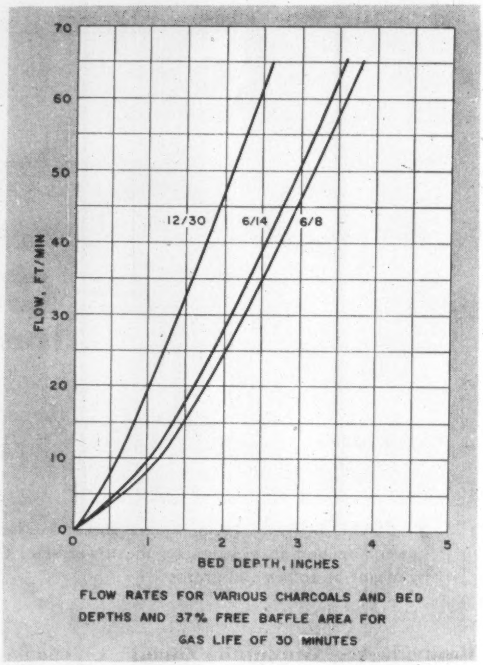
The design required approximately six air changes per hr, with a discharge temperature at the furnace of 106 F. The maximum temperature of the air introduced at the registers is approximately 85 F. Inasmuch as the air entering the room at the register outlets is approximately equal to or lower than skin temperature, it will feel comfortable to the skin. The supply air is introduced in a vertical plane from the register and blankets the cold exterior wall and glass areas with tempered air.

The air handling capacity of the floor far exceeds normal requirements. With all the air supplied from the inside wall of the classroom, 1000 cfm can be passed through the floor at 200 fpm at 0.01 in. of water column static pressure. Studies indicate that friction losses through the cavity floor are no greater than would exist in normal ductwork of equal area.

There are many variations to the above system that are possible. For example, a furnace and supply duct could be installed for each classroom for individual room control. The individual furnaces can be installed in a common heater room or in a closet installation adjacent to each classroom.



Atomic blast and chemical, biological and radiological agents demand special consideration in planning shelters. Here is helpful design data for planning air conditioning, ventilation and filtering for these shelters.



1 WITH PHOSGENE as the agent, carbons of three different sizes yield the above curves

How To Plan

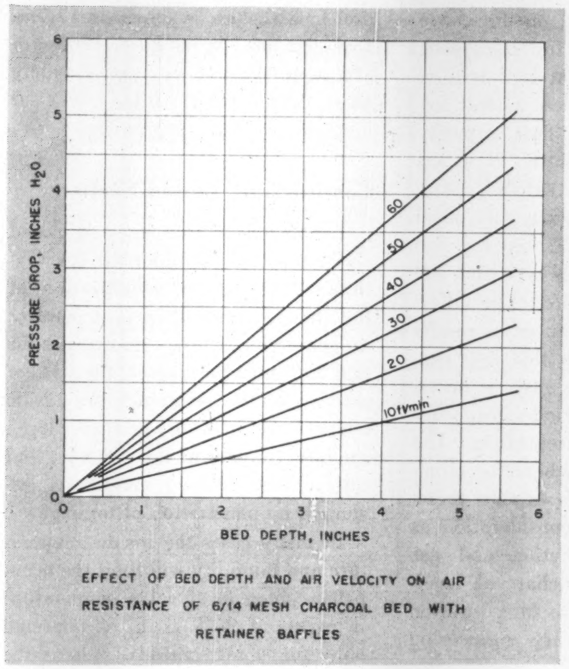
Air Conditioning for Protective Shelters

By Warren Viessman
Chemical Corps, U. S. Army

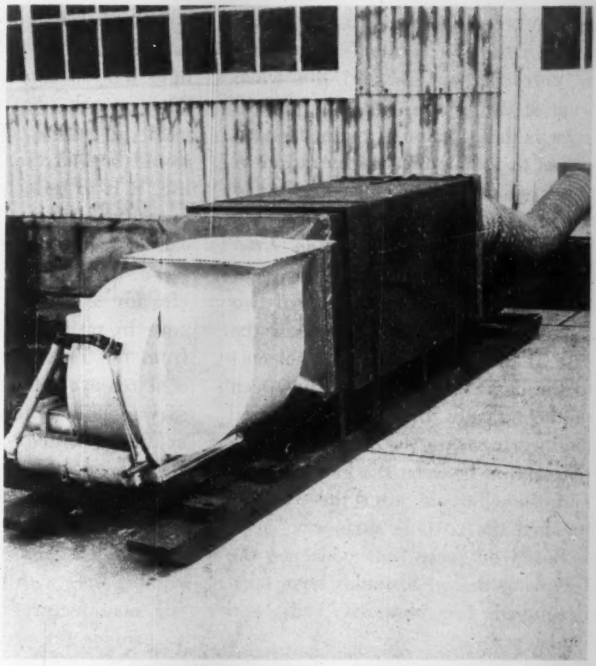
THE CONTROL of atmospheric conditions in protective shelters and the elimination of toxic agents can be accomplished three ways: (1) by introducing under pressure outdoor air which has been purified by particulate and gas filters; (2) by admitting no outdoor air for limited occupancy in closed shelters; and (3) by revitalizing the air in closed shelters.

Gas and Vapor Removal

Many of the foreign gases of the atmosphere are selectively adsorbed by charcoal. Included are organic gases, such as those emanating from animals and people, alcohols, ketones, esters, gaseous products of putrefaction and various toxic gases and vapors used for military purposes. Certain gases like ammonia and formaldehyde, carbon monoxide, and carbon dioxide are not adsorbed or have negligible adsorption by charcoal.[14] [All references are listed on page 127 in the November 1954 HPAC.]



2 INITIAL RESISTANCE of gas filters can be approximated from the above curves



3 COLLECTIVE PROTECTOR UNIT, driven by a gas engine, has a blower and filters with a capacity of 1200 cfm

Coconut and coal activated charcoals are widely used and differ in their adsorptive capacities. The effectiveness of a charcoal as an adsorber depends on the surface area of the particles and on the cavity of pore structure. For most efficient results, charcoals are activated by some process, usually consisting of crushing, briquetting, carbonization and steam activation.

Activated charcoal is, on occasion, impregnated to add to the charcoal a material which it does not have initially as an impurity, and which promotes the adsorption of a specific toxic agent which is not readily adsorbed by the unimpregnated charcoal. Impregnants either react directly with the gas being adsorbed, or act as catalysts, promoting physical adsorption, oxidation, decomposition, hydration, hydrolysis, and perhaps reduction. In many cases more than one reaction may occur. For most installations, unimpregnated charcoals are adequate for atmospheric odor removal. For special applications and the removal of toxic agents, a large number of impregnants are utilized. For instance, brominated charcoal is used to retard the metabolic process by adsorption of the ethylene given off in the cold storage preservation of plants, fresh foods and flowers. Activated charcoals for the removal of war gases are usually impregnated with copper, silver and chromium.

Design of Sorbers, Filters

Three types of carbon adsorbers, using basically either coconut or coal activated charcoals, are commercially available: a flat plate adsorber, an accordion pleated filter, and a cylindrical canister.[1]

The design of a charcoal adsorber or gas filter is based on four assumptions or concepts:

1) *Wave Concept.* When a gas-air mixture is passed through a charcoal bed, the concentration drops rapidly with distance traversed into the bed. This concentration or wave front advances with time of flow, until the steep concentration wave front penetrates the leaving charcoal bed surface with a definite concentration and the filter is no longer effective.[6] This wave concept has been applied to various chemical engineering diffusion processes for the past two decades and is quite well known and accepted.

2) *Capacity Concept.* Regardless of the mechanism of the reaction occurring at the charcoal surface, adsorption, decomposition or oxidation, each charcoal has a basic capacity for each test agent at the test concentration. This basic capacity determines the total quantity of gas with which a given layer of charcoal can react, and therefore determines the rate of advance of the concentration wave.

3) *Two-Layer Concept.* This concept considers the charcoal bed as composed of an active layer and a

critical layer. The active layer is that layer of the bed between the leading or entrance surface and the wave front at the break point. The critical layer is that portion of the bed which serves to reduce the concentration of gas from the initial concentration to the break through concentration.

4) *Diffusion and Reaction Concept.* The rate of removal of the agent by the charcoal is a function of two separate factors. One of these is the rate of diffusion of the gas molecule to the charcoal surface and has been mathematically treated in chemical engineering texts, the other is the rate of reaction between the gas molecule and the charcoal after the gas has reached the particle surface.

Based on these four concepts, the following design formulas have been developed for charcoal beds and canisters:

Bed depth —

$$\lambda = (C_1Qt)/(NA) + [\log (C_1/C_2)\ K_1\ (1000Q)^n]/A_b \ \ldots\ldots\ldots\ldots [1]$$

Air flow resistance —

$$P = K_2(1000Q)\ \{\ (2.00/A_b) + [(\lambda - 2)/A]\ \}\ \ldots\ldots\ldots\ldots [2]$$

where λ = charcoal bed depth; A = bed area; A_b = open area of retainer baffle or screen; C_1 = influent gas concentration; C_2 = break through concentration; K_1 = constant depending on particle size; K_2 = constant depending on particle size; N = specific saturation capacity of the charcoal; n = constant depending on test agent; P = pressure drop; Q = air flow; t = break through time.

From Equation 1, the curves in Fig. 1 have been calculated for three carbons of different U.S. standard sieve, fine series, particle size 6 to 8, 6 to 14, and 12 to 30 and for a retainer screen or perforated sheet of 37 percent free area. These curves are based on phosgene gas life of the filter before break through of 30 minutes, and for an influent gas concentration of 10 mg/liter.

On this basis for the 6 to 14 charcoal and for a bed of 1½ in. depth, the maximum velocity flow rating of the filter would be 19 fpm, and for 2¼ in. depth, the velocity flow would be 34 fpm. Two 24 in. x 24 in. x 8¾ in. commercial type accordion pleated filters, each with a ¾ in. impregnated charcoal bed, would have a flow capacity, based on the above calculations, of 427 cfm, since each filter has an equivalent face area of 22½ sq ft. If three filters are used in series, the flow capacity would be 765 cfm for the same gas life. It is to be noted that this rating is quite different from the usual catalog rating of 1000 cfm for one ½ in. bed filter of this type and 700 cfm for one ¾ in. filter. The difference in rating for war gases results from the requirement that 100 percent removal of these gases is necessary for a definite period of exposure at the specified concentration. The selection of gas adsorbers for elimination of toxic war gases must therefore receive special consideration as to charcoal impregnation and gas contact time with the charcoal. Leading manufacturers are in a position to provide the necessary engineering required to meet the special requirements.[1,20]

The initial resistance of the gas filters, calculated from Equation 2, can be approximated from the curves of Fig. 2. For the triple filter considered above, having a 2¼ in. bed depth of 6 to 14 charcoal and a flow of 34 fpm, the pressure drop would be about 1.3 in. The double filter with a bed depth of 1½ in. and a velocity of 19 fpm would have a resistance of about 0.6 in.

A suggested arrangement would include a viscous coated crimped wire mesh or fiber glass prefilter, the absolute particulate filter and double or triple gas filters under positive pressure to avoid suction leakage of contaminated air. A bypass and tightly fitted dampers could be provided the charcoal filters where it is desired to conserve their use in collective protectors until such time as a gas attack might be expected or indicated by an alarm.

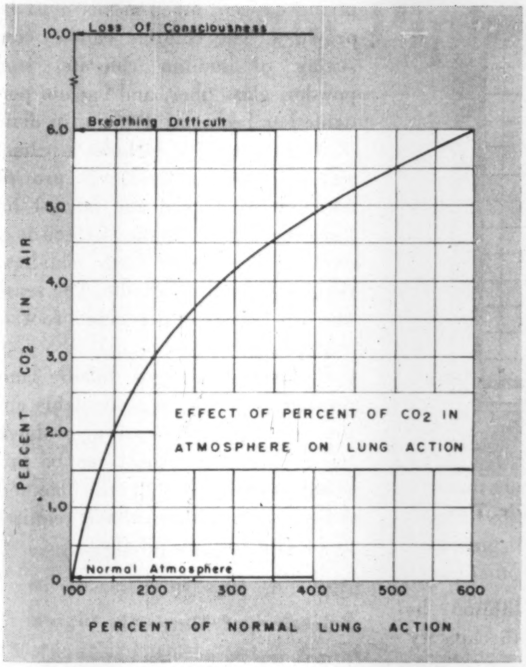
A Chemical Corps prototype collective protector, consisting of an engine driven blower, particulate and gas filters with flexible duct connection to a shelter, is shown in Fig. 3. This unit has a capacity of 1200 cfm and occupies a space approximately 44 in. wide, 9 ft 8 in. long, and 40 in. high.

Conditioning Closed Shelters

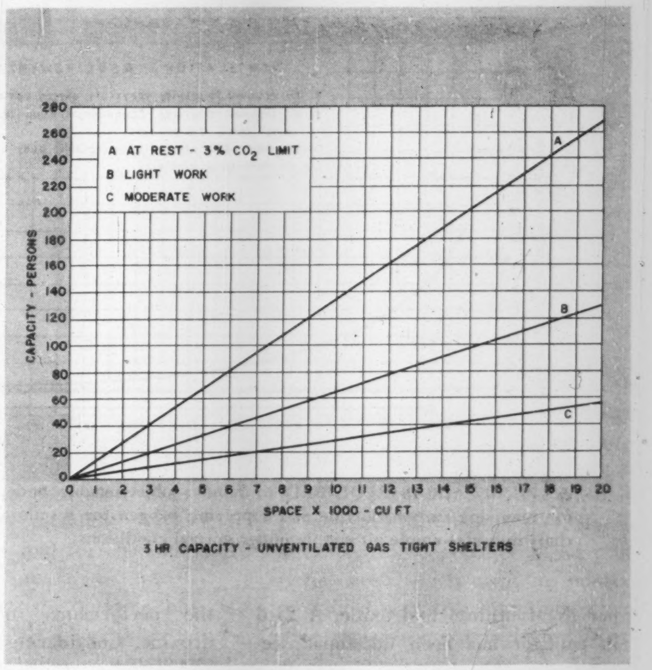
The length of occupancy of closed shelters without outdoor air for ventilation or without revitalization of the indoor atmosphere is dependent on population density; that is, volume and floor area per person, the state of activity of the personnel, the inside temperature, humidity and odor level, the heat transfer of the structure and the outdoor weather conditions, assuming no penetration of toxic gases.

In many cases the inside temperature and humidity will limit the occupancy, since an effective temperature in excess of 85 F could be tolerated only for short periods. Where the temperature and humidity can be controlled by air conditioning, or is not a problem, the carbon dioxide concentration will be a controlling factor. The depleted oxygen supply in the shelter will be adequate even when the shelter has been occupied long enough to increase the carbon dioxide content to 10 percent, which would cause loss of consciousness. Test results indicate that the oxygen content of air may be reduced from the normal volumetric content of 21 percent to 14 percent without harmful effect. The minimum for normal breathing is 10 percent.[10] Tests have indicated that an increase in carbon dioxide content to 3 percent, coupled with an oxygen decrease to 17 percent, is the practical limit for safe occupancy. During the tests, the temperature ranged between 58 DB, 53 WB and 77 DB, 75 WB. The physical fitness of personnel to perform their usual normal tasks dropped in some cases to 35 percent. At 3 percent carbon dioxide the lung or breathing effort is twice normal, as seen in Fig. 4. Higher contents are physiologically undesirable for any extended exposure.

Underground and surface closed shelters are usually designed for three hours occupancy. The capacity is limited by the rise in carbon di-



4 **PHYSIOLOGICAL EFFECT** tests of varying concentrations of carbon dioxide show that 3 percent is the practical limit for safe occupancy



5 **ATMOSPHERIC CONTROL** in closed, unventilated shelters should be based on curve *B* or *C* to avoid excessive temperature, humidity and odor

oxide to the practical limit of 3 percent. It has been determined[15] that for hermetically sealed shelters,

$$V = (TN)/0.04 \quad \text{.................} [3]$$

where V = the volume in cu ft; T = the time in hours to reach 3 percent carbon dioxide; N = number of people.

For three hours,

$$V = 75\ N \quad \text{.................} [4]$$

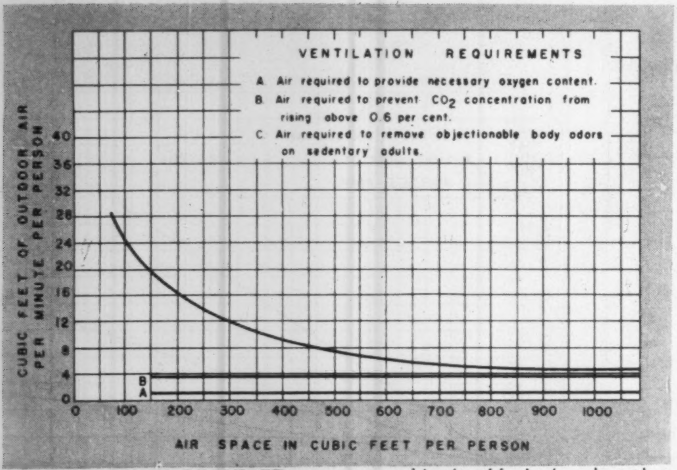
or, 75 cu ft of space is required per person, based on a rise of carbon dioxide content to 3 percent in 3 hr. This is equivalent to a ventilation rate of 0.417 cfm per person.

A man at rest in normal outdoor air requires an average of 0.275 cfm for oxygen. This rises sharply with exertion. At a walking rate of 3 mph he needs 0.888 cfm, and at 5 mph, 2.18 cfm. Curve *A* of Fig. 5 shows a 3 hr occupancy based on 0.417 cfm, which is the limiting condition for 3 percent carbon dioxide. Occupancy based on this curve would permit only 9 sq ft floor area for an 8.3 ft ceiling. Packing to this extent would in most cases cause excessive temperature, humidity and odor levels, resulting in fainting, nausea and panic. Curve *B* is based on the equivalent of 1 cfm per person, provided by the building volume for 3 hr occupancy. This is 180 cu ft per person. It would permit a greater activity level where necessary, and a floor area of 21.6 sq ft per person. Curve *C* provides 2 cfm per person, or a volume of 360 cu ft per person, permitting greater physical activity and more favorable conditions of temperature, humidity and odor. The design of a closed, unventilated shelter should be based on capacities as indicated by curve *B* or *C*.

Air Revitalized Chemically

Atmospheric revitalization in a closed shelter can be accomplished by chemical means. A number of materials and methods are available. Tests run under conditions from normal to 3 percent carbon dioxide and 17 percent oxygen have indicated that about 0.89 cu ft of oxygen is required per man-hour, and 0.74 cu ft or 0.09 lb of carbon dioxide are liberated per man-hour[25] in closed shelters, for usual normal activity. Since the efficiency of chemical oxygen liberation and carbon dioxide absorption is affected by atmospheric conditions of temperature, pressure, humidity, oxygen and carbon dioxide concentrations, a design value of 1 cu ft of oxygen per man-hour is usually assumed. An experimental respiratory quotient of 0.83 is used to determine the amount of carbon dioxide released. This quotient is the ratio of carbon dioxide liberated to oxygen consumed. The carbon dioxide generated per man-hour for 1 cu ft of oxygen would therefore be 0.83 cu ft. These basic assumptions will be used in the following consideration of various chemical agents.

Lithium Hydroxide. This material in a pelleted form, 4 to 14 mesh particles, has been used successfully in 2 in. deep canisters for the absorption of carbon dioxide. About 0.124 lb are required per man-hour. It will absorb about 6.74 cu ft of carbon dioxide per lb. Sensible heat produced by the reaction is 150 Btu per cu ft of carbon dioxide absorbed, plus heat required to evaporate 0.375 lb water



6 MORE AIR IS REQUIRED to remove objectionable body odors than for removing carbon dioxide and supplying oxygen for sustaining life. This chart indicates ample air supply under normal conditions

per lb of lithium hydroxide. A 21.6 lb canister has been developed, requiring an 80 cfm blower operating at 2½ in. static pressure.[12] The agent requires replacement every 2 hr.

Soda-Lime. This is commercially available as "Cardoxide" or "Sodasorb," and can be used for carbon dioxide removal.[17] It will absorb 2.45 lb of carbon dioxide per lb. About 0.34 lb are required per man-hour. The sensible heat generated by the reaction is 135 Btu per cu ft of carbon dioxide. Water vapor is also produced by the reaction. This material can be used in canisters with blowers and is available in granule form, 4 to 8 mesh particles, with an indicator which changes from colorless white to blue when sodium hydroxide has reacted to form sodium carbonate.

Baralyme. This material is available in pill form, 3/16 in. diameter × ⅛ in. thick, with an indicator which changes from pink to blue when the absorbent is exhausted. It contains no free water. It will absorb about 1.56 cu ft of carbon dioxide per lb on a 4 hr operation basis. About 0.474 lb are required per man-hour. This material is not superior to lithium hydroxide on an activity basis, and is over twice as dense. It requires about three times the weight to be exposed simultaneously to equal the performance of lithium hydroxide. Considering both capacity and activity, it is superior to soda-lime, and the dust created on loading hoppers is not as irritating. It costs about 27 cents per lb as compared with 37 cents for soda-lime and $2 for reprocessed lithium hydroxide.[13]

It therefore has a marked economic advantage where weight and space are not prime factors.

Sodium Super-oxide. One lb of this material will provide 3.94 cu ft of oxygen and absorb 2.88 cu ft of carbon dioxide. About 0.288 lb are required per man-hour. There will be 174 cu ft of sensible heat liberated per cu ft of carbon dioxide and oxygen. No water is formed.

Potassium Tetroxide. This material, known as "KOX," is also available for use in canisters and will simultaneously provide oxygen and absorb carbon dioxide.[26] There will be 3.27 cu ft of oxygen liberated and 2.28 cu ft of carbon dioxide absorbed per lb. About 0.364 lb are required per man-hour. Canisters containing 15 lb have been used, operating at 40 to 50 cfm. The charge requires replacement at 1½ hr intervals. The sensible heat liberated is 147 Btu per cu ft of carbon dioxide and oxygen. No water is formed by the reaction.

Chlorate Candles. For carbon dioxide absorption systems not supplying oxygen, other means must be provided. The chlorate candle, consisting of sodium chlorate, iron powder, glass fiber, and barium peroxide has been cast 4 ¾ in. in diam × 10 in. long.[26] It includes a primer and starting cap, and will provide 63 cu ft of oxygen and burn 1 hr. For each 1 lb of candle, 4.15 cu ft of oxygen is released. Each man-hour requires 0.24 lb of candle. The sensible heat released per cubic foot of oxygen in 94 Btu.

Compressed Oxygen. Where compressed tank oxygen is available and the containers are not a problem, the oxygen requirement can be provided economically by this method. A regulatory release valve is required to control the rate of flow.

Selection of Materials

The selection of the chemicals and system for revitalization of the air will depend on economic factors, local availability, and upon the type and size of the shelter. The system selected should preferably be one that adds the least amount of moisture or humidity to the shelter, generates the least heat, except for Arctic installation, and one that provides the least fire hazard. In regard to the latter, a punctured "KOX" canister might create a serious fire hazard if oil or other oxidizable material were to enter the punctured canister. An oil hazard also exists with bottled oxygen. Satisfactory safeguards can usually be set up for the above materials when applied to most underground or blast resistant shelters. In air conditioned shelters, temperature and humidity added by the materials can be removed or controlled by the air conditioner.

A closed shelter, to be densely populated for an extended period, should be provided with a means of removing obnoxious body odors in order to avoid nausea and panic. This can best be accomplished by recirculating the air over activated charcoal absorbers.

The first part of this two part article was published in the November HPAC.

Plastic Piping Use To Increase

Wider application seen because of new developments of special properties

• Chief properties and typical applications for six of the leading plastic piping materials are given in this report. Resistance to corrosion, low resistance to fluid flow, ease of installation and the light weight are some of the advantages that are being found in this new piping material.

PLASTIC PIPE is in for wider applications. Its use is on the increase, because of the special properties of the various plastic materials from which pipe and fittings are made.

The plastics most widely used for pipe and fittings are acrylonitrile copolymer blends, cellulose acetate butyrate, polyethylene, polyvinyl chloride (PVC), polyvinylidene chloride (saran), and combinations of glass fiber with thermosetting resins. Some of their chief properties are summarized in the accompanying tables.

Some Applications, Properties

Polyethylene, although not the oldest in piping use, has been the most popular in recent years. It is flexible and chemically inert. Applications include drain tubes for flue liners and piping in chemical plants. It is also used for the in-hole pipe pair in jet wells. It has been used for a "take-up" and "put-down" skating rink in winter and is stored in coils in summer.

Permanent networks of polyethylene pipe have been used in floor panel heating installations. Generally, water is circulated at 115 F through the piping by a high velocity pump.

In England, polyethylene pipe has been officially recognized for cold water services, overflow, flush and warning lines, and for chemical and food industry piping.

Cellulose acetate butyrate pipe is used in oil fields where high paraffin crudes deposit solid wax in other types of pipe and where severe corrosion problems exist. It is also used for lawn sprinkler systems, and for gas service lines up to the building foundation wall. Butyrate is available as a clear, transparent material which permits inspection of contents, as is often desired in food handling equipment.

Resistance to Corrosion

Resistant to corrosion, butyrate pipe has been used industrially to pipe highly carbonated ground water, salt water and industrial wastes. It is usually buried below the frost line.

The plastic pipe materials offer low resistance to flow. For example, 1 in. butyrate pipe will deliver about 50 percent more water than clean pipe of a more conventional material under the same head loss.

The acrylonitrile copolymer blends are rigid plastic materials which are about 10 percent lighter than butyrate and about one-seventh of the weight of steel. Minimum supports in overhead installations represent an advantage of copolymer blend pipe. It has been widely used in industry to combat corrosive conditions where pipe replacement is high and where good impact resistance is desired. Typical applications giving satisfactory service are in a spray tower line handling 170 F dilute sulfuric acid, outlet lines for wet chlorine on electrolytic cells, bleach solution lines in paper mills, and drum filter lines in sewage disposal plants handling acidic ferric chloride solutions.

Polyvinyl chloride pipe and fittings have been used extensively in Europe for over 20 years. Chemical plant piping handling acid solutions and gases has been in service for 15 years, and gutters and downspouts of this material in corrosive atmospheres have been used for over seven years. Rigid PVC also has good outdoor weather resistance.

Polyvinylidene chloride is similar to PVC in physical and chemical properties. It is used for gasoline fuel lines and for sewer and drain lines.

TABLE 1 — PHYSICAL PROPERTIES of plastic pipe materials

	Polyethylene	Acrylonitrile copolymer blend	Cellulose acetate butyrate	Polyvinyl chloride	Polyvinylidene chloride	Glass fiber reinforced resin
Specific gravity	0.92	1.06	1.20	1.40	1.70	2.0
Tensile strength, psi at 75 F	1500	5000	5000	6500	5000	11,000
Thermal expansion in. per in. per F x 10^{-5}	10	5.0	7.5	4.0	4.0	1.1
Thermal conductivity Btu per hr per sq ft/F/in.	2.3	1.0	1.7	1.2	1.0	2.3
Flammability	burns slowly	burns slowly	burns slowly	self-extinguishing	self-extinguishing	burns slowly

TABLE 2 — PLASTIC PIPE DATA, showing bursting pressures and recommended operating pressures for pipe sizes of different materials

Material	Nominal pipe size, in.	Wall thickness, in.	Bursting pressure, psi at 75 F	Working pressure, psi		
Polyethylene				to 140 F		
	½		450	135		
	¾		360	110		
	1		275	80		
	1¼		250	75		
	1½		210	65		
	2		180	55		
	2½		175	50		
	3		170	50		
	4		160	48		
	6		115	35		
Solvent welded butyrate				to 60 F	to 120 F	to 180 F
These estimated safe working pressures have been calculated at 20 percent of actual bursting pressure	½			199	133	67
	¾			143	96	48
	1			143	96	48
	1¼			139	93	46
	1½			156	104	52
	2			129	87	43
	2½			113	76	38
	3			90	61	30
	3½			97	65	32
	4			87	58	29
	5			85	57	28
	6			87	58	29
Standard wall acrylonytrile copolymer blend				to 70 F		to 170 F
	½			150		75
	¾			150		75
	1			125		60
Standard length, 10 ft and 20 ft	1¼			100		50
	1½			90		45
	2			75		40
	3			60		30
	4			60		30
	6			50		25
Rigid PVC Schedule 80				to 160 F		
	½		1635	150		
	¾		1375	125		
	1		1275	125		
	1¼		1095	125		
	1½		985	100		
	2		860	100		
Polyvinylidene chloride Schedule 80			at 77 F	to 77 F		
	½		1300	260		
	¾		1060	210		
	1		970	190		
	1¼		820	160		
	1½		740	150		
	2		620	125		
	2½		570	115		
	3		510	105		
	4		460	90		
	6		400	80		
Glass reinforced						
	2⅞	0.20	900	100		
	2⅞	0.215	1200	200		
	3½	0.20	800	100		
	3½	0.215	1200	200		
	4½	0.23	900	100		
	4½	0.25	1200	200		

Entirely different from the above mentioned types of plastic pipe is that made of thermosetting resin and oriented glass fiber. This is a high-strength plastic pipe. It can be used at higher temperatures, has high impact resistance and is non-corrosive. It is an excellent pipe for specialized applications.

This article is part of a paper originally presented by J. S. Whitaker, of The Bakelite Co. at the Building Research Institute's recent conference on the use of plastics in building.

Promote "Professionalism" of Engineers

. . . at NSPE meeting

DURING ITS four day annual meeting at Milwaukee, the National Society of Professional Engineers "moved a step closer to its long range goal of wide professionalism of engineers." But as the convention closed, it was generally agreed "that the goal was still far distant."

A resolution was approved setting forth the policy that the NSPE direct its efforts toward a strong program to inform engineers and their employers of their joint responsibility in preserving the integrity of the engineering profession.

"Gentlemen's agreements" affecting the role of the engineer in industry were opposed by the NSPE since they "deprive the engineer of the right to seek employment in an effort to better himself, without jeopardizing his immediate position." The so-called "gentlemen's agreements" are those under which employers agree not to consider for employment an employee of a firm in the same general field or in the same geographical area, until that employee has first severed all connections with his immediate employer.

Harry A. Winne, who recently retired as a vice president of the General Electric Co., spoke at a dinner concluding the meeting.

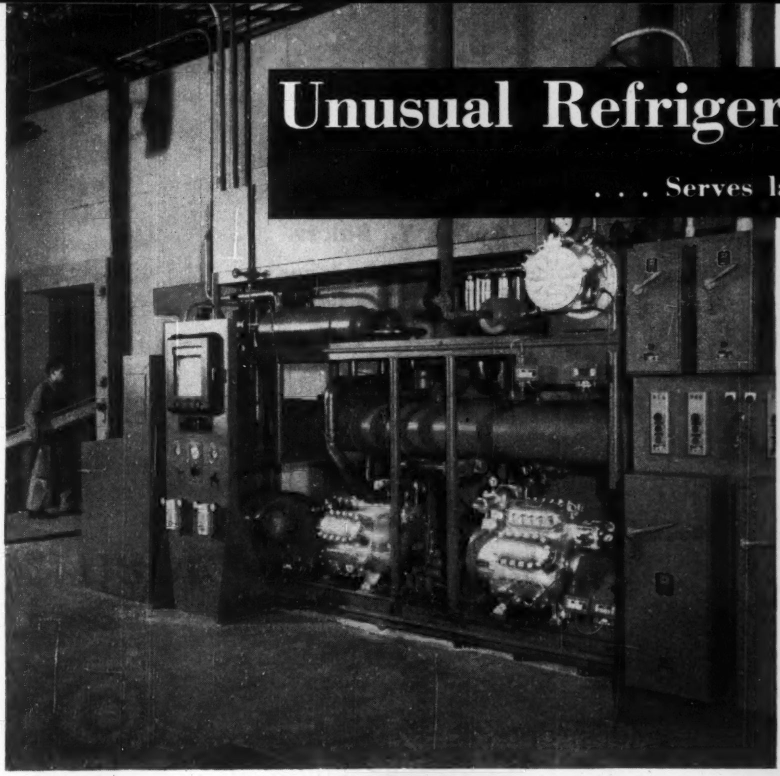
Management needs to recognize several things about its engineers and their professional interests, he said.

The good professional engineer is part of the management group and wants to be recognized as such. He wants to know broadly about the business. He wants easy two-way communication between himself and his supervision. He wants free access to his supervision. He wants recognition. He wants opportunity to play a part in his entire profession. He wants his ability to be used to the fullest extent. He wants a challenging job. He wants adequate remuneration.

Engineers themselves must share part of the burden, he declared. They should arrange to obtain professional engineer licenses and to associate themselves with professional forces.

Unusual Refrigeration System

. . . Serves laboratory cold rooms



• Two sets of coils permit one to be defrosted while the other carries the load. Two stage system uses three compressors.

By Donald H. Krans
Laboratory Director
The Trane Co.

An unusual two-stage cascade refrigeration system is installed in two low temperature cold test rooms of the new research and testing laboratory of The Trane Co. at La Crosse, Wis. The cold rooms are designed to provide new facts about frost formation on low temperature coils, methods of designing these coils to cope with frost, and more practical methods of defrosting.

The larger of the two rooms is designed for temperatures as low as −25 F, the smaller for −65 F.

Two 50 hp reciprocating compressors maintain required temperatures in the cold rooms. A third 7½ hp compressor is used for hot gas defrost of cold room coils.

How The System Works

"Freon-12" gas from the high temperature, 50 hp compressor goes to a shell-and-tube water-cooled condenser. Cooling water from the city water supply enters the condenser at about 52 F and leaves at about 65 F. The liquid "Freon-12," subcooled by a suction-to-liquid heat exchanger, passes through an expansion valve into a combination evaporator - condenser. The "Freon-12" picks up its latent heat in the evaporator and cools "Freon-22" from the discharge side of the low temperature stage, "Freon-22" 50 hp compressor.

This combination unit is thus an evaporator for the "Freon-12" from the high temperature compressor, and a condenser for the "Freon-22" from the low temperature compressor. "Freon-12" at about 15 F cools the "Freon-22" in this unit, after which it returns to the high temperature compressor to repeat the cycle.

The "Freon-22" from the combination evaporator-condenser is then subcooled by a suction-to-liquid heat exchanger, after which it passes through an expansion valve to direct expansion cooling coils. Specially built fans draw air through these coils, from where the chilled air goes to the cold rooms through ductwork.

In the larger, −25 F cold room the chilled air descends into the room through a perforated false ceiling. In the −65 F room it is introduced directly through duct outlets.

Because the cold room air will be humidified by steam for testing coil performance under various conditions of frost-up, a quick means for defrosting the cold room cooling coils had to be installed, and it is essential that defrosting be done without interrupting laboratory tests.

An unusual method was used. Two sets of coils are provided, so one set can be defrosted while the other carries the load. For defrosting, a portion of the discharge gas from the low temperature "Freon-22," 50 hp compressor is bled through a water cooled intercooler, then into the suction side of a 7½ hp "Freon-22" compressor. The purpose of the intercooler is to reduce superheat temperature of the hot discharge gas from the low temperature compressor to avoid damage to the 7½ hp compressor.

The 7½ hp compressor then raises the pressure and temperature of the "Freon-22" and discharges it directly into the cold room cooling coils at 127 psi and 105 F for defrost.

The low temperature system is capacity controlled by automatic unloaders on the eight cylinder, 50 hp compressors. Oil separators are installed on both compressor discharge lines, driers are installed in liquid lines, and strainers are installed ahead of all expansion and solenoid valves.

Case Histories from a Consulting Engineer's files

By C. T. Baker
Consulting Engineer

Heating Problems Can Be Avoided

. . . if the design's right, if the installation's made properly and if the system is operated and maintained intelligently

• ***These case histories show what was done to achieve satisfactory heating performance in a motel, in a two-story unit group of buildings and in a small industrial plant. In each case, the heating system was either not designed, installed or operated in the way it should have been.***

CASE NO. 1 —

Motel Guests Want Heat

The manager of a motel court which consists of 11 separate and isolated cottages, each divided into two units, was constantly bombarded with complaints from the over-night guests about the lack of heat. "Turn on the heat," they pleaded.

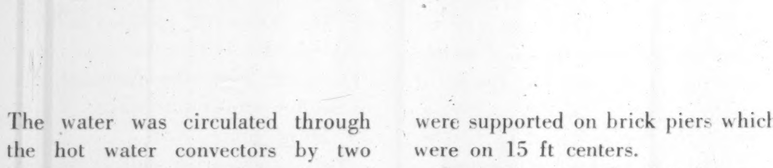
An investigation of the design of the system disclosed some interesting anomalies. All units were heated with hot water supplied from a central plant which consisted of a 563,000 gross Btu per hr hot water boiler. The water was circulated through the hot water convectors by two booster pumps, one a 2 in. size and the other a $2\frac{1}{2}$ in. The system was divided into two circuits, each served by a single circulator. Fuel oil with a calorific value of 130,000 Btu per gal was used in an oil burner with a maximum firing rate of 5.7 gal per hr.

Including the elbows and other fittings, the combined supply and return line of each circuit was equivalent to 1125 lineal ft of $1\frac{1}{4}$ in. pipe. For the most part, the supply and return mains were outdoors. They were supported on brick piers which were on 15 ft centers.

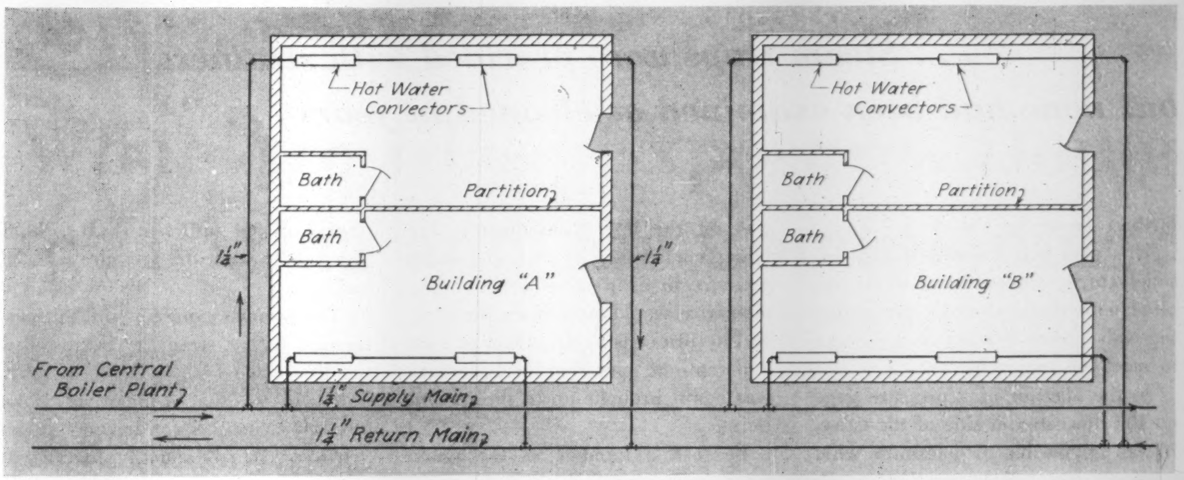
Connections to the interior convectors were made as shown in Fig. 2. The supply and return lines outside the buildings were supported as shown in Fig. 1. There were a number of things that appeared to contribute to the prevention of satisfactory performance of the system as a whole;

1) Absence of air vents in the piping system.

2) Settling of the supply and return mains due to settling of brick supporting piers that rested on


Sheet Metal Over Insulation
Sheet Metal Held Down by Heavy Tile Weights
Supply Main 1¼"
Brick Piers
1¼"
Return Main
15'
15'

1 OUTSIDE SUPPLY AND RETURN MAINS were insufficiently insulated. Hollow tile, to hold down sheet metal covers on the insulation, imposed an additional load on supporting piers



2 ALL UNITS for the 11 separate cottages were heated with hot water from a central plant. Motel guests complained about lack of heat

loose sand; this formed pockets in the mains.

3) Improperly insulated lines.

4) Incomplete insulation of both the supply and return mains, which were underground.

5) Supply and return lines too small.

6) Circulators not capable of developing the pumping head required to handle water in sufficient quantities through the long lines of pipe and through the convectors.

It is difficult to understand why hot water heating system designs too often fail to include air vents, since it is so well known that the presence of air in the system is sure to cause trouble sooner or later. The air expansion tank above the boiler is often considered to take care of the air problem.

That sounds fine but, unfortunately, air has a habit of making "stop overs" enroute to the tank. In fact, some of it never reaches the expansion tank; it hides out in the high and low places in the piping system, as many can testify.

An interesting thing about the settling of the supply and return lines was the additional load imposed on the brick piers supporting these lines.

This extra loading consisted of sections of hollow tile placed on top of sheet metal covers that rested directly on the pipe insulation. The sheet metal was intended to protect the 85 percent magnesia covering from damage due to rain. However, since the wind had a habit of blowing these loosely fitted metal sheets away, someone conceived the idea of using heavy sections of tile on top of the sheets to prevent this loss.

Placed on 2 to 3 ft centers, these weights caused sagging of the lines between the supporting piers and also caused the piers themselves to settle in the soft sand on which they rested.

This combination of conditions was responsible for much of the water circulating troubles, since it created many air pockets.

Recommendations for putting this system in shape to operate satisfactorily included the leveling of all pipe lines external to the buildings, reconditioning of the pipe insulation and providing the exposed insulation with weatherproof finish.

In the meantime, two new circulators were installed that were designed for an operating head which would insure an adequate supply of hot water to all convectors. One of these units required a ¼ hp motor and the other a ½ hp motor. The increase in working head of the new circulators, as compared to the old, was due to the long pipe lines and numerous right angle elbows.

The owner preferred to install higher head circulators rather than increase the water lines from 1¼ to 1½ in.

Clearly, here was a situation that had been handled largely by rule-of-thumb methods and in which proper consideration had not been given to the question of hot water requirements, pumping head and overall pipe design and installation practices.

CASE NO. 2 —

Case of the Weighted Valve

In the two story unit of a group of buildings, a central boiler plant supplied steam to a number of single-pipe cast iron radiators. Near the structure was a valve which reduced the pressure from 75 to 15 psi. Pressure on the downstream side of the reducing valve could be varied by changing the position of a weight on a long lever, which was a part of the valve assembly.

Last winter, the diaphragm on this valve developed trouble and caused unsatisfactory regulation of the steam supply to the radiators. To remedy the situation, the weight was merely moved to the far end of the lever. Later, finding the first measures inadequate, more weight was added by tying together several bricks and some chunks of concrete, which were suspended from the end of the lever

> ***" . . . Steam traps were provided with strainers, but none had been examined or cleaned in years . . . "***

farthest from the valve.

This plan was considered to work satisfactorily since all radiators supplied with steam through the reducing valve were heating well enough to meet the requirements.

In the absence of a pressure gage on the downstream side of the valve, it was impossible to determine what pressure was being supplied to the radiators. However, beyond doubt, it was greatly in excess of the safe working pressure of the radiators.

In order to protect the radiators in this building, as well as those in two other buildings of the group, each pressure reducing station is now provided with a steam gage and a safety valve on the low pressure side of the system. In addition, the hand valves on the full size bypasses around the reducing valves will be provided with means for locking the valves in the closed position to prevent their being opened by unauthorized persons.

In far too many instances where buildings are heated in the manner just described, no thought is given to the matter of safety against rupture of equipment when it is subjected to pressures greatly in excess of its safe working pressure.

The officials of this institution complained about high fuel costs. An investigation of the layout as a whole brought to light some interesting facts:

1) All of the condensate from the heating coil of the large generator that supplied hot water to the convectors of a two-story building was going to waste to the sewer.

2) Only a small percentage of the steam and hot water lines in service were insulated.

3) No provision had been made for blowing the tubes of the fire tube boiler — they were scraped by hand once a week.

4) No damper was installed to close the stack draft while the stoker was off the line. Consequently, the boiler cooled rapidly, causing steam pressure to drop more quickly than otherwise would have been the case, and in turn causing the stoker to start and continue operation until pressure was again brought up to the cut-out point.

Because a number of the steam traps in service had not been properly supported, they had settled sufficiently to interfere with normal operation.

Most of the traps were provided with strainers, but none had been removed for examination and cleaning in the several years that they had been in service.

The officials agreed that the efficiency of the system depended greatly on proper maintenance, so plans were made to bring about some very necessary improvements.

CASE NO. 3 —

Industrial Boiler Corrected

A small industrial plant operated a return tubular boiler, rated at 125 hp. It was set in the usual brick setting and hand fired with nut and slack coal. A steel stack, 30 in. in diameter × 60 ft in height, supplied natural draft. A hand damper in the stack uptake provided means for draft control. After some years of service, a windstorm blew the stack down, badly damaging the upper 10 ft section.

Since it was necessary to restore operations as quickly as possible, the stack was placed back in service minus the 10 ft section. This time it was more securely guyed with heavy steel wire fastened to steel beam sections buried deep in the ground and cemented over. During periods of heavy steam demands, it developed that even with the damper wide open there was not sufficient draft to hold the required steam pressure of 125 psi.

The fireman came up with the suggestion that a steam jet be installed in the uptake just above the damper, pointing out that locomotives make use of steam jets for exhaust steam when traveling and live steam at other times, and that, furthermore, locomotives had a very short stack but always had plenty of draft.

As this seemed like a good suggestion, the manager approved, and the jet was installed. It consisted of a section of $\frac{3}{4}$ in. pipe flattened at one end and turned upwards in the center of the stack. A 1 in. steam supply line furnished live steam from the main steam supply pipe.

The scheme worked fine and all was well — until one day when it was discovered that the stack was not long for this world. It was almost eaten up by the sulphur in the flue gases that combined with the condensed steam to produce sulphurous acid.

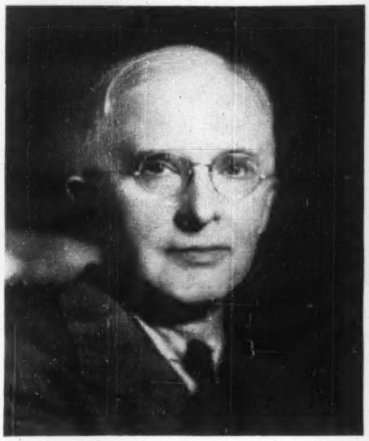
A new stack was ordered to replace the old one, which upon removal collapsed when raised above the boiler before it could be landed safely on the ground.

A later investigation of this boiler plant disclosed the cause of poor draft. The boiler brickwork was in such a state of disrepair that cracks and openings appeared at every turn. The 50 ft stack had been overloaded by having to carry away large quantities of cold air that entered the setting through these many cracks and openings, not only killing the draft but carrying large quantities of valuable heat to waste.

After the brickwork had been effectively repaired and coated with a sealing coat, a product easily obtained, the damper was closed about 50 percent, and the fuel bill went down accordingly.

SAM LEWIS' PAGE

What Are Glass Exposures Doing to Heating and Air Conditioning?



SAMUEL R. LEWIS, consulting mechanical engineer and a member of HPAC's board of consulting and contributing editors, comments informally each month on practical heating, piping and air conditioning problems.

A LONG TIME AGO in the southwest, when walls made of dried earth tended to melt down when wet, some genius projected the roof with wide overhanging eaves. This prevented the rain water from washing the walls away. In a single story building today, the overhanging eaves protect the walls and windows as well. Some time ago, there was a definite cycle during which the custom was to economize on construction costs by inserting a second story between the foundation and the roof, but the overhanging roof continued to be added.

Many skyscraper buildings of 25 years ago were built with wide overhangs, presumably ornamental, that shielded the top story from rain. Many such buildings had 30 or 40 other stories that received no such protection. In time, the projecting roofs became decrepit and pieces of them would fall off, doing no good to the pedestrians on the sidewalk. Contractors in many cities have been experiencing quite a boom lately in removing these old cornices.

Horizontal and vertical louvers and slat type fins have come into use in the last few years. Their main purpose is to minimize the solar load that would otherwise be imposed upon the air conditioning equipment. Of course, they also reduce the solar gain in the winter, which aids in controlling the results obtained with the heating system. The matter of rain protection is incidental now, it seems.

Buildings used to have walls. It seems to me that there is a tendency now to overdo the glass and to underdo the wall. Without going into the matter of their desirability from the architectural viewpoint, they do present problems to heating and air conditioning engineers. Plate glass windows from floor to ceiling in stores are fine to display merchandise. However, they do not appeal as a means to display human pulchritude to the neighbors in apartment houses. These glass apartment houses are exceedingly hard to keep warm in winter and to keep endurably un-hot in summer.

The idea of a skeleton of steel for tall buildings has been developed by architects where beams at each floor level are employed to support the local one story walls and windows of that story only. If the windows are conventional, a tall thin beam with its top at the window sill level and its bottom level with the ceiling below, can occupy the wall space between columns. This wall acts as the vertical flange of a horizontal angle which supports the edge of the floor below the wall, instead of the wall being supported by the floor.

The architects of course teach the engineers how to design buildings. But the engineers occasionally may help to keep the architects out of trouble. Some skyscrapers that have been built recently with glass walls have defeated the engineers because they are not walls at all, heat-wise. In one big manufacturing plant, glass block walls 500 ft long were supported on thick concrete beams that connect the columns below to the glass blocks. The concrete refused to contract and expand at the same rate as the glass, with the result that carloads of glass blocks were broken before adequate expansion joints could be provided.

In another case, to do away with alleged leaky skylights, thick glass plates were imbedded flat wise in a concrete slab roof. The glass and the concrete of course were incompatible as to rates of expansion. After spending a fortune in trying to stop the leaks, it became necessary for the owner to install additional water-shedding skylights above the plates.

Summer cooling by refrigeration is approaching universal practice. Roof and wall construction which reduces the heat transfer rate aids in the design of the installation by keeping the system simpler, and aid in its operation by simplifying control and cutting costs.

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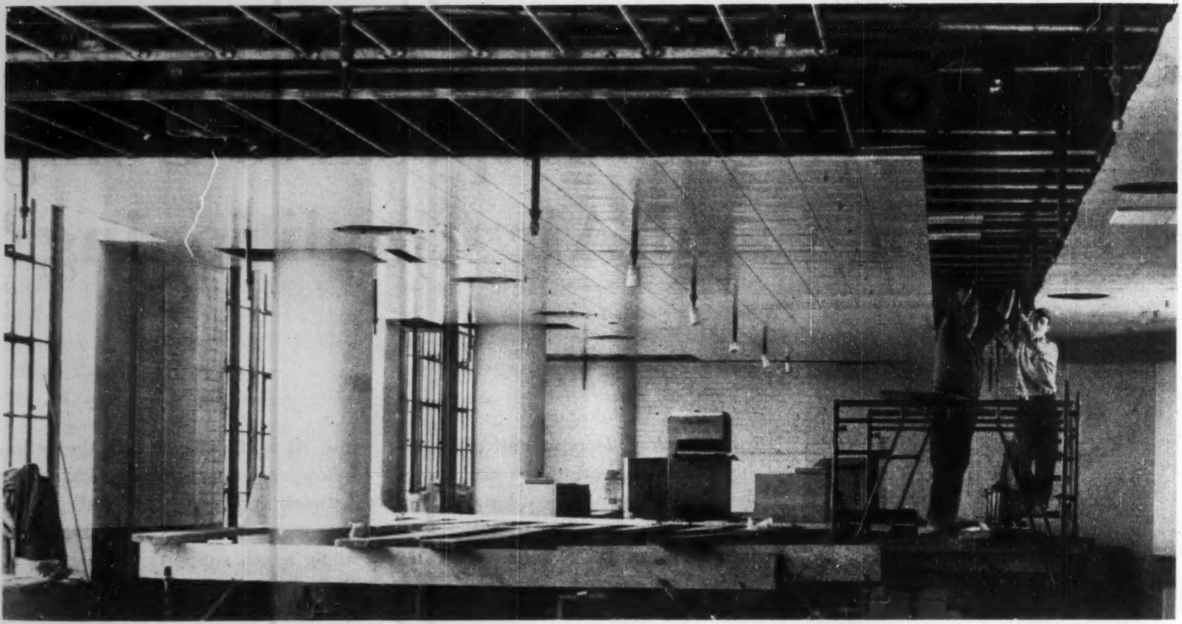


1 PICTURE of the partially installed perimeter radiant cooling ceiling in the Port of New York Authority building is shown here. Chilled water will be circulated through pipes to which perforated aluminum panels are clipped.

Radiant Cooling Cuts

A UNIQUE FEATURE of the comfort conditioning and acoustic control of the 16 story Port of New York Authority building in New York is a new radiant cooling ceiling installed on the south and east perimeter to share the excess solar load and cut the total load on the new air conditioning system. The ceiling consists of a standard suspension system to which is attached a grid of galvanized piping. This piping is used as a base for an acoustic thermal blanket and a surface to which aluminum panels are clipped. The radiant cooling panels are installed in 14 and 20 ft wide strips along the south and east sides. A total of 26,500 sq ft of this ceiling will be installed on the 15 floors in the next few years.

Originally built for industrial use, with pillars supporting each floor, the structure has large window areas on all sides for light and ventilation. After part of it was adapted as an office structure, it was found that the south and east windows allowed the sun to pour in during many days, causing discomfort to the occupants. When it was decided to air condition and sound condition the building, it was determined that the solar load through these windows would impose an almost intolerable burden on the air conditioning system, requiring an excessive number of air changes per hour. The excess solar loads absorbed by the panels would have required from three to five air changes on all east and south zones above normal.

The total cooling load will eventually be 19,800,000 Btu per hr, of which the radiant ceiling will carry 450,000. Calculations indicate that the perimeter ceiling will relieve the air conditioning system by a minimum of 17 Btu per sq ft, although chilled water piping for the panels has been sized to circulate a flow based on a rate of 21 Btu per sq ft.

The basic air conditioning system consists of eight fan rooms strategically located throughout the building. The air is filtered electrostatically and is then tempered and sent to the various air handling units. After being cooled or heated as necessary to maintain temperature and humidity, it is delivered to the various rooms through conventional diffusers.

2 THE PERIMETER PANELS blend in with the remainder of the ceiling when the installation is complete, as shown here.

Air Conditioning Load

. . . in existing building

Chilled water is circulated from two 1000 ton steam driven compressors in the basement. An old elevator shaft is used for the water piping from the basement to the floors above. Water, after being circulated through the cooling coils in the system at 45 F, with a resulting temperature rise of 10 F, is then recirculated through the radiant ceiling at 60 F, a further temperature rise of 5 F.

Controls for the radiant ceiling, which are completely automatic, consist of time switches, low limit stats and three-way valves. The air conditioning controls consist of three-way valves, automatic steam valves, humidistats, thermostats and high pressure selectors. Low limit stats are set at approximately 57 F to maintain the water temperature above the room dew point, which is about 55 F. The three-way mixing valve mixes water from the air conditioning unit to maintain a water temperature of approximately 60 F in the radiant ceiling at all times.

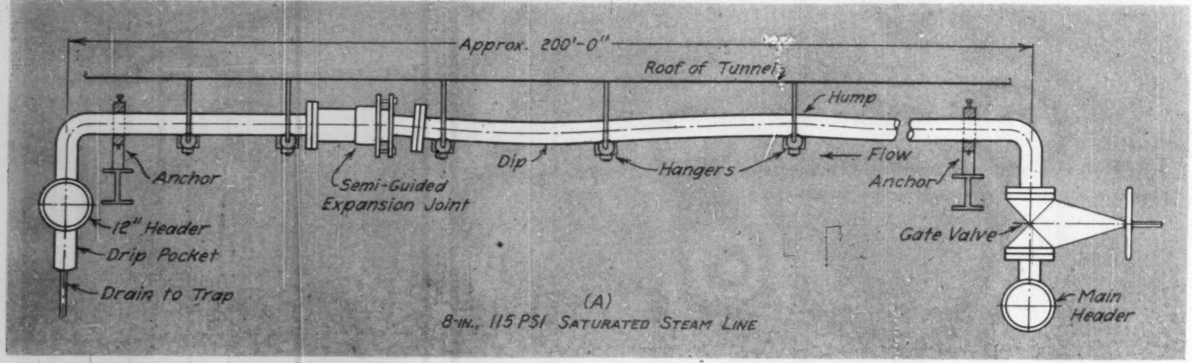
The time delay switch set for 30 minutes allows approximately five air changes in the conditioned rooms before the panel pumps start. Immediately, cool air is introduced into the entire room as well as the perimeter area. This insures a lower relative humidity to prevent condensation on the panels.

During hot weather, room air temperatures are maintained at 78 F, with a relative humidity of 45 percent, when the outside temperature is 95 F. Provisions have been included in the air conditioning system for circulating 10 complete changes of air per hour in the air conditioned rooms. This air change rate may be lowered eventually, depending on the actual performance of the radiant cooling ceiling.

Although this type of ceiling has been installed in other buildings throughout the country, its purpose before has been either radiant heating only or both heating and cooling, with acoustic control. This is the first time that the ceiling has been utilized for radiant cooling solely for reduction of the air conditioning load, plus acoustic control.

The general contractor was Perfect Contracting Co., and the mechanical contractor was Buensod-Stacey, Inc.

PRACTICAL PIPING PROBLEMS



WITH SATURATED STEAM there is always a certain amount of condensate in the bottom of the line. The flow of the steam will carry some of it over the humps, filling the drip pocket at the low end, but there will still be considerable amounts of it lying in the valleys

Expansion Produces Water Hammer

What happens when improper expansion joint piping jams the sleeve? More than water hammer can be the result, as Martin MacVane explains here to his friend Doc Waite

By Bill Dopp

• *Bill Dopp has had some 40 years of experience dealing with piping, including a long stretch of service as a sales engineer. He is devoting part of his present leisure to drawing on his many piping experiences. All the names are fictitious.*

This month, Mr. Dopp's principal character, Martin MacVane, investigates a serious case of water hammer in a steam line for his friend Doc Waite. See if you agree with his recommendations on how to correct it.

"HELLO, MAC," Doc Waite, superintendent of the Howard Chemical and Dye Works, greeted his gasket salesman friend, Martin MacVane. "Sit down a few minutes; I'll be right with you."

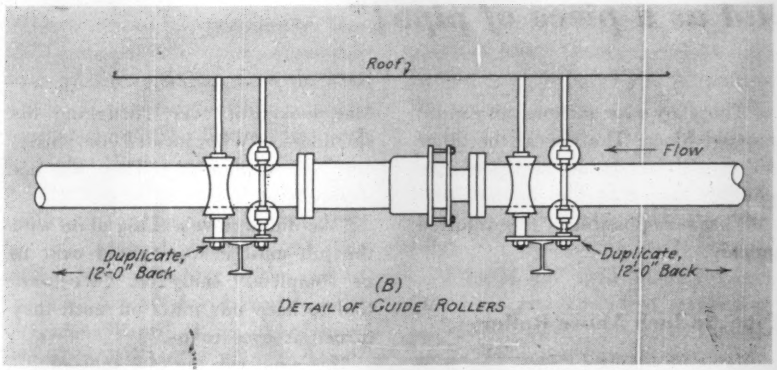
"Okay, Doc," replied Mac, as he seated himself in the comfortable chair near the engineer's desk. He looked around the busy process room, noting the wisp of steam that flagged a little stuffing box leak. He quickly sensed some kind of excitement in the plant. Mac's nose for trouble — and his eyes and ears — soon found a clue to what was happening. A terrific thump in the piping on the other side of the room clearly indicated dangerous water hammer. When the blow was repeated several times, he got up and walked over to the scene of confusion. Doc — and the engineer, Joe Brown — were watching a steam header high up on the wall with evident apprehension. A lesser blow followed Mac's arrival but it still shook the entire piping structure.

Water Hammer Like a Barrage

"Mac, I'm scared," said Doc, turning to his visitor. "Every time we try to start that double effect evaporator, this steam line starts a barrage that scares the daylights out of everybody. I've never heard water hammer like that. I'm afraid it will bring down the whole line every time it gets going. I just can't figure out where the water comes from."

"How long has this been going on?" asked Mac.

"For about three weeks," answered Joe. "Ever since the new tunnel line was put into service. We never had



IMPROPER USE of a semi-guided expansion joint. Hangers on each side of the joint act not as guides but as fulcrums, and help jam the sleeve

this kind of trouble before."

The noise seemed to have subsided, so the three walked back to the desk. Mac turned to Doc thoughtfully. "So you've put in a new tunnel line — why?"

"We've been adding such a heavy load to that steam header," replied Doc, "that we just couldn't get out production without more steam. Management hollered, but it had to be done. We would have to shut down a couple of pumps and a dryer to start the evaporator. Now we can't start it without nearly wrecking the plant."

"Who designed the line?" asked Mac.

"Those brilliant engineers that the firm hires up in the big city. They know all the answers." Doc made a disparaging gesture.

"Don't get bitter, Doc," counselled Mac. "Engineers do make mistakes, but I doubt that they are responsible for this."

"Who else could be?" demanded the superintendent.

"I don't know," replied Mac, grinning. "You sure you're not to blame?"

"What?" shouted Doc, furious. Joe, too, appeared shocked.

"Quiet down a minute and tell me what the engineers did. How much changing they recommended and who did the work." He gently pushed Doc into a chair, sitting down himself. "Maybe when we get all the facts we can figure out what is going on in that line. Those fellows did not intend it to act this way."

"Well," explained Doc grudgingly, "you know that the power house is on the other side of the street. We had a five inch steam line coming over here to supply this process room and steam to the plant heating system. These fellows came down here, asked a lot of questions and recommended that we put in an eight inch line. They suggested we use the old five inch line for additional hot water so we would not have to use our steam over here to heat all of it. That seemed like a good idea. They changed the header from eight to twelve inches and ran a new heating line up the main stairwell to the top floor. We got a lot of water hammer out of that line when we put that into service, too."

"So far, the plan is all to the good," declared Mac approvingly. "They give you two and a half times the steam you had before and reduce your load by supplying the hot water. Is that line drained?" He paused. "By the way, what's the steam pressure and how long is that tunnel?"

"We carry one hundred fifteen pounds at the power house," replied Joe, "reducing for the different services over here. The dryers use only fifteen pounds of steam. The tunnel is about two hundred feet long. If I recall correctly, the slope of that line is one quarter of an inch in ten feet. That gives it a five inch drop to that ell above the header over there. You can see the drip pocket directly under the inlet. It's trapped, so it should be draining all the time." Mac detected a note of hesitation.

How About Expansion?

"How about expansion?" inquired Mac casually.

"Oh, they had to use expansion joints in the tunnel. You see, that tunnel is pretty small. It's only five feet six high and about six feet wide. They had a time putting it through in the first place. When the city made them get rid of the overhead lines, they also made them avoid the sewers. Seems we are always between the devil and the deep blue sea."

"Expansion joints," mused Mac, frowning. "Guided, I suppose?" He looked at Doc.

"What's the matter?" questioned Doc, sensing a change in Mac's attitude.

"Nothing," answered Mac slowly, "only I'm always preaching about the mis-use of expansion joints. They sometimes get people into trouble because they're taken for granted. Engineers don't always understand the very special requirements of their use." He paused, shaking his head "I'll bet that the expansion joint in that line is frozen solid. Can we get a look at it?"

"Mac," said Doc with a trace of sarcasm in his voice, "you're saying that the expansion joint is producing water hammer. That sounds plain silly to me."

"It may sound silly, Doc, but if my hunch is right, you have a lot more trouble on your hands than

". . . The sleeve is cramped and rigid. That expansion joint is as solid as a piece of pipe!"

just water hammer. I'll be surprised if that whole line isn't in serious difficulty."

"We'll have to go into the tunnel from the other end. It's hot in there, too," said Joe. "We have to keep this end of the tunnel closed up tight or we'd freeze to death in here in the winter. The cold draft we used to get from that hole would nearly knock you down. We'll go over on the other side and work along to the joint. You coming, too, Doc?"

"You bet your life I'm coming. I've got to see this with my own eyes."

"Let's go," laughed Mac. "We may all learn something."

When they got over to the power house, Joe turned on the lights in the tunnel and opened the doors in the end of the shaft. Mac borrowed a jumper from one of the men, and the three climbed into the hole in the wall, sweating before they had gone ten feet. Mac kept a flashlight playing along the under side of the largest line in the tunnel. He paid careful attention to the way the line rode on the hanger rollers and frequently stopped to make a more careful examination of some particular location. Finally the expansion joint appeared near the far end of the tunnel. Mac's light flashed over the sleeve and he poked Doc in the ribs. "Get a load of that," he said. "Just as I thought. Frozen solid!"

"What do you mean, frozen?" demanded Doc.

"Look at this thing, Doc. It's supposed to have a movement of about four inches, but you can see that it has not moved over an inch, if that much. The sleeve has been cramped sideways and is held rigidly in that position. From then on, the joint is as solid as a piece of pipe. The expansion has to go somewhere else." He walked to the end of the tunnel, flashing the light at the supports. Doc and Joe watched him.

"Those are nice anchors, all right," asserted Mac. "The one at the other end is still intact, too, so the expansion has been taken up in the line."

"That's impossible," Joe retorted quickly.

Pipe An Inch Above Roller

"Is it?" snapped Mac. The heat was irritating all of them. "Come here," he commanded, leading the way. "Look at this hanger. The pipe is at least an inch above the roller. Here is another one, even worse. It not only has moved up, but is away over to the rear so that it has damaged the covering. That load is almost on the tip of the roller." As they moved along the line, Mac pointed out several other spots where the pipe was out of line, sometimes up, often to one side or the other, or even down. He pointed to the five inch line, which seemed to ride its hangers perfectly. "Where's the joint in this line?" he asked, as they emerged from the heat of the tunnel. Answering his own question, he remarked, "Oh, I see. They have taken up the expansion of that line with this long beam along the wall. It's not as hot as the other one, either."

"What are we up against?" Doc asked Joe, while Mac was getting back into his coat. "That line is dangerous. Guess Mac was right when he said we were in more trouble than we knew." He walked over to the perspiring gasket salesman. "Mac, I think you have proved one point but I still am doubtful about that water proposition."

"Let's go where we can sit down and cool off," suggested Mac. "Have you got a drawing of this system?" he asked.

"There's a drawing in the office," replied Doc.

Seated in the comfortable air conditioned conference room, Doc spread a drawing out before them. Mac looked it over, shrugging his shoulders. "Who located the hangers?" he demanded. "They are not shown here."

"We didn't have a thing to do with the job until it was turned over to us complete," said Joe. "We were told to keep our mitts off until they turned it over to us."

"Let's not rub the sore spots, Joe," cautioned Doc. "The fact is, Mac, we know very little about it. Tell me, where does that water come from?"

Valleys Accumulate Water

Mac drew a sketch of the line, spacing the hangers approximately as he remembered them. Putting an anchor on the I-beams at each end of the tunnel, he sketched in the joint, exaggerating the up and down undulations of the line and the cramp in the expansion joint sleeve. "If you will look at that line, you can see that there are a number of valleys where water can accumulate. With saturated steam, there is always a certain amount of condensate flowing in the bottom of the line. The flow of the steam, if it is steady, will carry some of this water over the humps, filling the drip pocket at the low end, but there will still be considerable amounts of it lying in these pockets."

"There shouldn't be any pockets," protested Doc sharply.

"I know. We'll get to that presently, Doc. Right now, let's see what Joe does to create that water hammer."

"Me?" questioned Joe, looking shocked.

"Yes you, Joe," asserted Mac. "When you open that evaporator valve, you do it quite rapidly. The evaporator is relatively cold. Steam rushes into the coils, condensing quickly and demanding more steam to fill the gap. You have suddenly increased the flow in the eight inch line, raising the velocity of the steam perhaps one hundred percent, say from five thousand feet to ten thousand feet per minute. This will continue until your evaporator coils get pretty warm, when the flow will begin to steady down to a nearly fixed demand. The line velocity will be higher, but it will be steady."

"I get it," declared Doc. "It's the sudden change in velocity that picks up the retained water in the line pockets and carries it to the end of the line. No wonder it sounds as if a cannon ball had hit that elbow above the header."

"One of those slugs could easily rupture that line," exclaimed Joe.

"You're right, Joe," conceded Mac. "I don't blame you for being scared, Doc. You have reason to be. I can see an idea dawning on Joe here. It's good, Joe, to heat the evaporator slowly, but that takes time and slows production. The best thing is to fix that main line."

"What caused the trouble in the first place?" Doc inquired.

"Improper use of a semi-guided expansion joint," explained Mac. "These joints must be carefully guided, or they will get into just this kind of trouble. Someone thought that by putting hangers directly on each side of the joint, he was guiding it. That only made the matter worse, because the hanger acts as a fulcrum to help jam the sleeve. Even the so-called guided type of joint needs a perfectly straight pipe line to keep out of trouble."

"Why should this pipe take such a crazy, wavy pattern? I thought that expansion always acted in a relatively straight line," argued Joe.

Like Any Other Force

"Expansion acts like any other force, Joe," replied Mac. "It will take the path of least resistance. You see, an inexperienced welder can set up some queer stresses in a line while welding a pipe joint. It may look straight while it is cold but when it is heated, the differences in the stress relationships within the joint will tend to bend the pipe in the direction of the least stress. You can get some pretty snaky pipe lines from poor welding technique."

"Those fellows were working in rather cramped quarters, too," remarked Doc. "How in blazes are we going to fix this line? Something has to be done — and fast. The whole thing should come out and be done over, but upstairs would never stand for that. I'm sure they will say it's our baby," he complained disgustedly.

"First of all," said Mac, "I'd cool that line and free that expansion joint. Then work a couple of I-beams across the tunnel on each side of the joint so you can put guiding rollers on both sides of the pipe as well as the bottom and top. Put a set close to the flanges of the joint and a second set about twelve or fifteen feet away on each end." Mac indicated on his sketch what he meant.

"How about the line pockets?" demanded Joe.

"When the line gets hot again, check the sleeve to be sure it is moving free and the hangers to be sure that you have an even gradient. Then check the rollers to see that they are actually supporting the pipe. If you find a gap under the pipe, better install a top roller there with some heavy springs to help hold the pipe down where it belongs. I'm sure that when you take off the expansion strains, most of the dips will disappear. If you find one that you can't get rid of that way, better weld a drain into the line at that point."

"I suppose a little dip here or there will make no difference," suggested Doc, "as long as they are not very big." He looked at Mac for support for the idea.

"No, Doc," warned Mac emphatically. "Any entrained water in a steam line, no matter how little, can be a source of danger. It may suddenly get into motion. Then it's as solid as lead. You have been hearing what kind of a blow it can deliver." He shook his head. "Keep that line dry or the water flowing freely with the steam to a point of elimination. Don't take any more chances than you have to."

"I would never have believed that a stuck expansion joint could cause water hammer," declared Doc, "if I hadn't seen that line myself. I wonder what the joint in the new vertical line is doing? Have you ever looked at it, Joe?"

Examine Vertical Joint

"Come on," said Joe, "let's take a look at it. I wonder, too, what that one has been up to. Gosh! I'm getting like Mac. Distrustful!"

"Don't get me wrong, Joe. These joints are all right if they are properly installed and regularly inspected. They have to be repacked every now and then and always after a period of idleness. They are good, if properly used."

One look at the expansion joint in the middle of the four inch line standing upright in the center of the big stairwell clearly indicated that this one, too, was frozen in an open position, although the line was hot. Mac looked up along the line. "It looks pretty straight," he said. "What's at the top?"

"A big tripod anchor," answered Joe. "Looks like a huge tent." They slowly made their way up the stairs. As they reached the top, Joe let out a shout. "Holy mackerel!"

They stood amazed. The rigid three prong anchor that was fastened to the floor and welded together above the welding ell on top of the pipe had literally lifted the floor. A slab about six feet square was raised at least two inches above the rest of the concrete. The applied force had actually sheared the reinforcing rods in the floor.

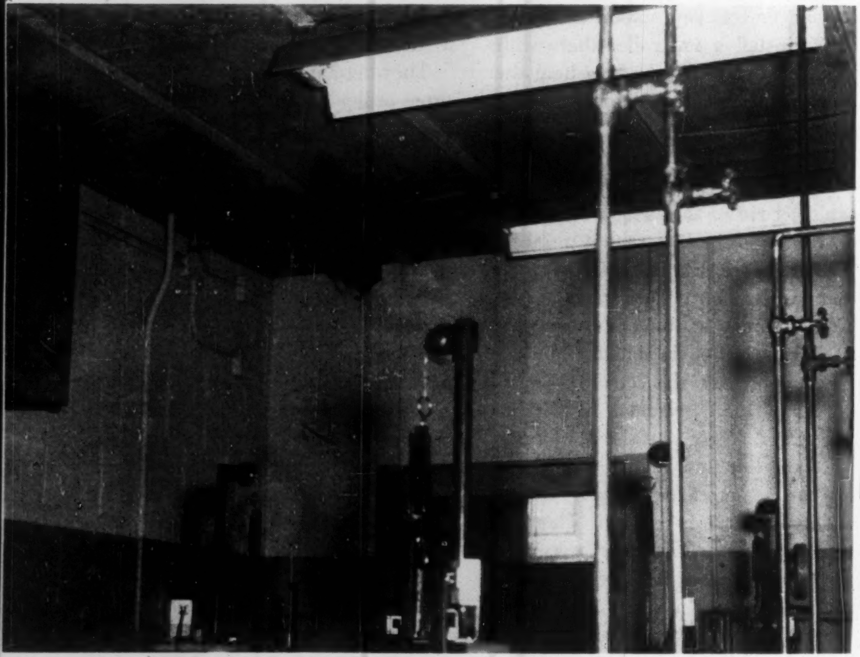
"Gee," said Doc. "That's nature at work. Would you believe it?"

"This is really stupid," asserted Mac. "Look at that long straight pipe beam up there. It would take care of ten times the expansion of that riser. For heaven's sake, take that expansion joint out of this line and junk it. Burn out this anchor and scrap that, too. This line is perfectly capable of taking care of itself, if someone does not try to restrain it."

"Don't take it so hard, Mac," said Doc, as they started down the stairs. "We'll fix it up pretty quick."

Controlling Air Conditions in a Very Small Test Lab

- **High cooling load in a cramped space was a challenge in this installation as well as in the design. Construction of an adjacent mezzanine and an above-ceiling plenum were required to solve this problem.**



SUSPENDED CEILING conceals air conditioning unit installed in plenum space above. Wet and dry bulb thermostats are mounted on bracket from ceiling near grille. Over 12 tons of refrigeration is needed for this 230 sq ft room

THE MOST DIFFICULT type of air conditioning installation is one that requires simultaneous control of both temperature and humidity. Although this type is becoming more common in industry, each job still presents some problems to both the designer and the installer. One recently completed for a laboratory test room at the National Carbon Co. plant in Fostoria, Ohio, had more than its share of problems. This was primarily due to the two basic requirements of the system:

1) The cooling load was to be approximately 12 tons of refrigeration in a room with a gross floor area of only 230 sq ft.

2) The amount of air to be circulated was to be about 4000 cfm, or the equivalent of 100 air changes per hour.

Compare these with the average system that is considered to have a high cooling load when it amounts to a ton of refrigeration per 100 sq ft of floor area, and a large number of air changes when they total 15 per hour. It is apparent that a very careful analysis of the problems was necessary.

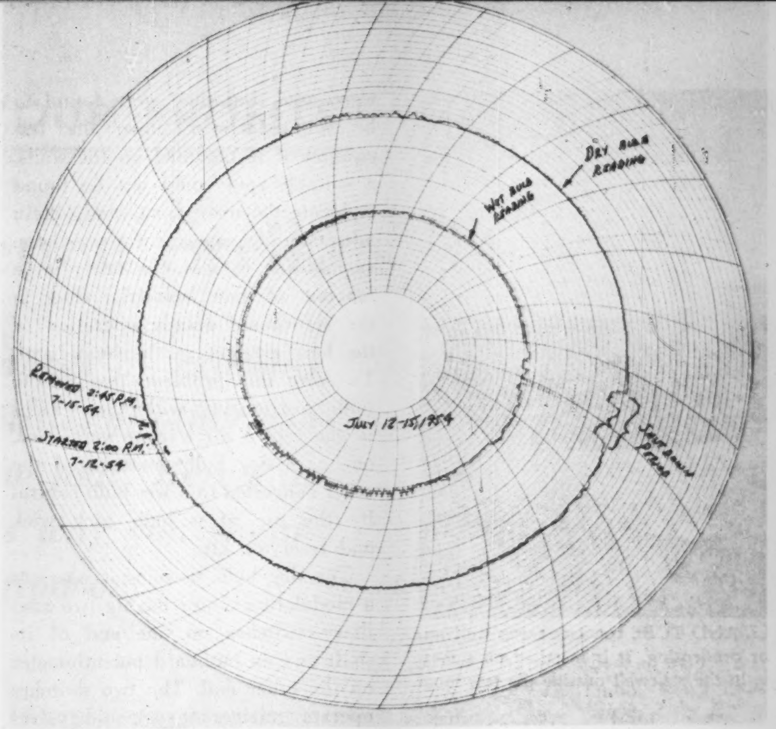
The company is one of the largest producers of carbon products in this country. And quality control is of paramount importance in all its products.

Test Facilities Enlarged

When it became evident that the available test facilities in the labora-

By Robert Greenwald

Manager, Air Conditioning Div.
The Lumm Corp.
Air Conditioning Contractor



OPERATION OF THE SYSTEM is carefully checked. Wet and dry bulb temperatures are recorded on a 72 hr cycle. Recording chart shows room conditions from July 12 to July 15, 1954. DB reading (outer line) averages 80 F, WB 64. Note effect of brief shutdown at right

tory building were no longer adequate, another test room was planned. In this building, space is critical, and it seemed impossible to spare any for the new test room. After considerable thought by key personnel in the laboratory, a space 19 ft long and about 12 ft wide was made available, which allowed an extremely bare minimum requirement. It required efficient arrangement of test machines and control equipment because not a square inch of space could be wasted.

In making production tests, it is important that temperature and humidity be controlled in order to insure reproducible test conditions. Only in this way can the extraneous factors that affect test variables be reduced to a minimum. The conditions specified for this room were 75 F DB ± 2 F, and 45 percent relative humidity ± 4 percent. Under ordinary circumstances, these conditions can be readily obtained with standard controls. Closer control was obtained with standard instruments than had been expected, as will be described.

High Cooling Load

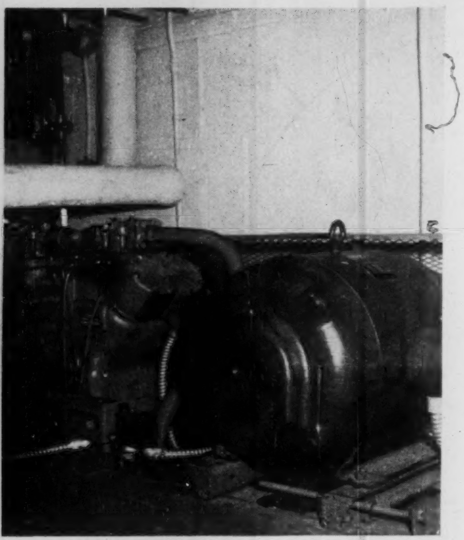
Because of the high concentration of heat producing equipment in the new test room, the cooling load amounts to over 12 tons of refrigeration in a space having a gross floor area of only 230 sq ft, or the equivalent of about 630 Btu per sq ft. This can be compared with the average cooling load in a restaurant of 120 Btu per sq ft, including the heat given off by the food being served and by heat producing equipment.

Since operating personnel are required to be in the test room for extended periods, it was not considered desirable to introduce the supply air at a temperature lower than 25 F below normal room temperature. This restriction caused the resulting air volume necessary to offset the heat load to be about 4000 cfm, or the equivalent of over 100 air changes per hour.

The logical method of supplying air to the room at that flow rate seemed to be through a perforated ceiling. A suspended ceiling was built in the room by laying large sheets of perforated cement asbestos board on parallel T-bar supports, the boards being easily removable for access to the space above the ceiling. The air conditioning unit was installed above the ceiling because no other space was available. The net amount of ceiling area remaining for air distribution is 160 ft, since that portion immediately below the unit could not be used. With this area, the velocity of the supply air entering the room is only 25 fpm. This is well below the accepted maximum for human comfort of 50 fpm. When the system was started, there were two drafty spots in the room, but these were eliminated by the use of baffles in the plenum space above the ceiling. Air distribution was then fairly uniform and acceptable for comfort.

Standard Equipment Used

The air conditioning unit is a horizontal type with a six row direct expansion cooling coil, a one row nonfreeze steam heating coil, steam jet humidifier and filter box with throwaway filters. The fan discharges directly into the plenum space. Recirculated air returns through a perforated grille in the ceiling with a short duct connection to the rear of the filter box. The outside air duct extends from a nearby window



SHELL AND TUBE condenser uses well water for condensing. It is installed on a mezzanine in the stairwell outside the test room

opening to the rear of the filter box, but it also has a single filter within the duct to remove coarse heavy particles from the air before entering the system. Approximately 90 percent of the total air is recirculated.

The refrigeration unit is belt-driven at 955 rpm by a 15 hp high torque motor. It has a shell and tube condenser with finned copper tubes and uses well water for condensing. Capacity is regulated by suction pressure controls that unload two cylinders in sequence down to 50 percent of full output when the demand decreases. The unit is mounted on vibration isolators to avoid objectionable transmission. Since space was at such a premium in the laboratory building, a mezzanine floor was constructed in the stairwell adjacent to the test room. The refrigeration condensing unit is there.

Changes Made In Controls

Modulating controls in conjunction with positive acting solenoid valves are used to govern conditions in the room. At first, a room type thermostat and a hair element humidistat were used, but they were found to be unsatisfactory. Since the test equipment is mounted on the walls, a suitable spot could not be found to locate the instruments and obtain adequate air movement over them. In addition to that, the fairly large amount of fine industrial dust in the air caused erratic operation of the hair element in the humidistat. To solve this problem, two remote bulb instruments with their bulbs in the return air stream were used, one as a dry bulb control and the other converted to a wet bulb control by the use of a bulb sock wick and reservoir kit.

The dry bulb thermostat operates a modulating motor having two auxiliary switches on one end of its shaft and an outboard potentiometer on the other end. The two switches operate refrigerant solenoid valves on the two circuit cooling coil of the air conditioning unit and may be adjusted to make or break the circuits at any point of the motor travel. The potentiometer operates a modulating steam valve on the heating coil of the air conditioning unit and is arranged so that there is full travel of the valve for 50 percent motor travel. On a drop in temperature from the condition where both refrigerant valves are open, these valves first close in sequence, and then reheat is provided by the steam valve opening. The cycle is reversed on a temperature rise.

The wet bulb thermostat operates another modulating motor having two auxiliary switches on one end of its shaft and one switch on the other end. The two switches on one end are in parallel with those on the dry bulb control that operate the refrigerant solenoid valves. The other switch operates a steam solenoid valve in the supply line to the jet humidifier. On a rise in wet bulb temperature from the condition where the humidifier is putting moisture into the air, the steam valve is first closed and then the refrigerant solenoid valves are opened in sequence to obtain dehumidification with the cooling coil. The cycle is reversed on a drop in wet bulb temperature. The steam heating coil provides the necessary reheat to prevent under-cooling when the cooling coil is being used for dehumidification.

Refrigeration Control Separate

Control of the refrigeration unit is independent of the room controls. The compressor cylinders may be unloaded to obtain a variation of 50 percent of full capacity in two steps, by means of electric valve operators in the cylinder heads. On a drop in suction pressure, the two cylinders unload in sequence under the regulation of suction pressure controls. The compressor remains on pumpdown control when the demand for cooling is so low that both refrigerant valves are closed.

After the air conditioning system was placed in operation, no changes were necessary beyond the normal amount of balancing and adjusting. The control arrangement permits considerable flexibility, due to the available adjustment of the cams, causing the auxiliary switches to make or break contact. A complete set of operating instructions and wiring diagrams in a glassine envelope are mounted near the main electrical panel for the system.

A recording instrument in the room provides a graphical record of the system's operation. It is a two-pen instrument on a 72 hr cycle that records both wet and dry bulb temperatures. A representative chart shows that the dry bulb did not vary over ± ½ F from the set point of 80 F. The wet bulb variation was ± ½ F for over half of the time and about 1 F for the remainder. These conditions were considerably better than had been expected with the instruments used.

Laboratory personnel at this plant have expressed satisfaction with the results obtained by this installation. These results, obtained under rather critical conditions, have led to revised thinking with regard to maximum permissible air quantities and unit cooling loads. However, the initial analysis proved to be correct on all major points.

THE LAW AND YOUR PROFITS

Negligence Strikes Twice

Are you taking chances by exposing yourself to the liabilities of other contractors on the same job? Here's an example that shows why you should check to find out

INTERLOCKING LIABILITIES of heating, piping and air conditioning contractors and other contractors on the same job are often a subject of contention. Sometimes such cases find their way into the courts and, as calmly appraised by judicial opinion, yield practical preventives and timely warnings. A recent example is technically — as well as legally — instructive.

Persons are re-named here as follows: Compresso-Cool Co., installers of a refrigerating unit in a store building owned by Murch & Dyzer; Fernis Corp., installer of an electrically controlled heating system in Murch's storeroom and in his property next door; Vick Timm, employee of Cautious Contracting Co., which company Murch retained to move the store building to a nearby lot.

The action spans nearly two years, during which time certain "remote" and "proximate" causes were at work, leading up to a tragic and costly climax. In September, Compresso-Cool installed the compressor with its cooling apparatus. They did this "carelessly," it was alleged, and in such manner that the apparatus was "negligently connected with the main switch and fuse box." In consequence, the compressor and cooler were not protected by the fuses and switch provided for that purpose, thereby creating "a dangerous and hazardous instrumentality."

WILLIAM HURD HILLYER, author of this regular feature, is a contributor to a number of banking and financial publications and has written several books on business. A former vice president of the Atlanta Trust Co., his work there gave him a practical legal background.

Negligence and Unskillfulness

During November of the following year, Fernis Corp., according to declarations filed in the case, "negligently and unskillfully" connected its electrically controlled heating system with a switchbox installed by Compresso. In so doing, Fernis caused the tube connecting the compressor with the cooler to be charged with electricity. This tube was under the store building between the floor and ground.

Things remained quiescent until July of the following year. Cautious Contracting then came to disconnect the store from the adjoining premises and move it to a new location as agreed. A crew of that firm's men, including Vick Timm, went underneath the store building to put the moving equipment in position. Meanwhile, the owner had disconnected the main switchbox supplying current to the store. Vick Timm came in contact with the tubing and was electrocuted.

Timm's administrator sued both Compresso and Fernis for the housemover's "wrongful death." The alleged cause was twofold — Compresso's negligence in hooking up the wiring for the refrigerating unit and Fernis' negligence some months later in wiring the electrically controlled heating system. As a result, after the main switch in the main switchbox was disconnected, current continued to pass through the wiring to the compressor and the floor furnaces.

Independent Ground Lacking

Lengthy and complex testimony was offered by the defense, all of a highly technical nature. This did not, however, satisfy the state court of appeals, which had the case from the lower court. In particular, the higher tribunal was dissatisfied because Compresso-Cool's star witness failed to explain "why he did not make an independent ground connection on the switchbox, which the record discloses would have prevented the charging of the BX cable leading from the switchbox to the compressor" — a situation that in turn caused Timm's demise. Nor was the court moved by the Compresso witness's statement that he had subsequently made two service calls at the property, "one of which required him to come in direct contact with the tubing" and had received no shock.

The court cited in detail five alternative "ifs" applicable to Compresso and four applicable to Fernis, each embodying some reasonably protective measure and any one of which would have doubtless served to prevent the tragedy. From the evidence, it appeared that the courses pursued by Compresso and Fernis embodied negligent acts which, though separate and distinct in themselves, continued in unbroken sequence to the point of Vick Timm's death. The only "unless" was the possibility that someone had tampered with the connections between their installation and the electrocution.

Both Firms Guilty

The defendants' effort to show tampering was characterized by the court as "a *non sequitur*." The verdict was sustained in favor of Timm's estate and against Compresso-Cool Co., together with Fernis Corp.

Although the contributing acts of negligence, none perhaps fatal in itself, were in two groups, separated by nearly a year, and although their tragic result was some two years after the first act was committed, these facts did not keep the acts themselves from being "proximate causes" of the electrocution. Nor did their apparently unconnected character prevent damages from being assessed against both firms.

[Note: While this discussion applies to an actual case, it should be remembered that legal rules vary in different states.]

QUESTION OF THE MONTH

How To Calculate Overall

THE QUESTION, *How Can We Calculate the Overall Heat Transfer Coefficient for a Wall with a Combination of Mass and Reflective Types of Insulation?*, was published previously in HPAC and is repeated here for information along with some answers to the question that have been received from HPAC's readers. Other comments for publication will also be welcome.

"We have been confronted with the problem of calculating the overall heat transfer coefficient of a frame wall in which a combination of mass and reflective types of insulations is installed. In other words, when two unlike insulations are used in the same wall — reflective and mass — how are the two different coefficients used in the calculation to determine the overall heat transfer coefficient?"

H. E. ROBINSON —

"Recent Studies Provide More Data"

TO CALCULATE the overall heat transfer coefficient of a building construction with mass insulation and reflective air spaces in series, the usual procedure of summing the thermal resistances of the various components is followed.

The total thermal resistance for solid materials, mass insulation, and indoor and outdoor surface films is computed, using the data and methods outlined in the ASHVE Guide or in Federal Housing Technical Circular No. 7, "Calculation of Building Section Heat Transmission Coefficients." The thermal resistance of the air spaces in the construction must then be calculated and added to the total.

The Guide, and Technical Circular No. 7, give data with which the resistance of the reflective spaces can be estimated. However, more recent and comprehensive data is currently available in Housing Research Paper No. 32, "The Thermal Insulating Value of Airspaces," published by The Housing and Home Finance Agency, available from the Superintendent of Documents, Washington 25, D. C., at 25 cents per copy. This paper, based on data obtained at the National Bureau of Standards, gives resistances determined for various typical air spaces, for various orientations, directions of heat flow and emissivities of the space surfaces, all of which influence the resistance. In addition, it gives basic data and procedures for calculating the resistances of spaces other than those already worked out in the paper. — H. E. ROBINSON, Mechanical Engineer, National Bureau of Standards.

C. E. LUND —

"I Believe the ASHVE Guide Has the Answer"

I BELIEVE that the answer to this question can be found in the Heating, Ventilating and Air Conditioning Guide for 1954, published by the American Society of Heating and Ventilating Engineers.

Where reflective insulation is used, the Guide merely changes the air space coefficient which is given for one side covered with a reflective material or two sides of an air space covered with reflective material. Where mass insulation is used, the resistance of this mass insulation

Color Coded Boiler Room

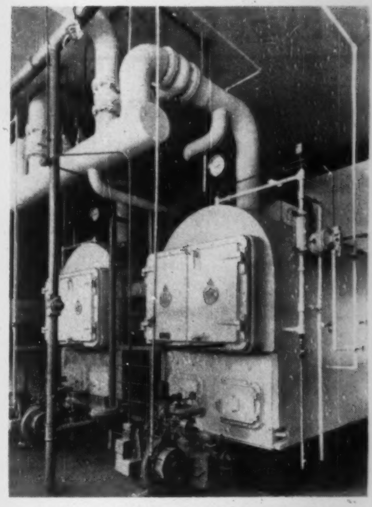
. . . pattern in pastels

A rainbow of pastel shades identifies the component parts of the heating system and other piping in the new Goucher Street elementary school in Upper Yoder Township, a suburb of Johnstown, Pa., according to The National Radiator Co.

The two boilers and the steam supply piping are painted yellow. Gas piping and the gas burners are painted blue. Red is the identifying color for water lines and boiler return lines are pale green. These colors, plus others, enable identification of various lines at a glance and make the boiler room look clean and efficient.

The heating and ventilating system represents an investment of $62,000. Original plans provide for future expansion as the enrollment increases. Space is reserved for a third boiler and all piping has been designed and installed to facilitate its placement.

The heating contractor was Wimber Plumbing Co., Wimber, Pa. Architects were Hunter, Caldwell & Cambell of Altoona, Pa. Mechanical engineers were H. F. Lenz Co.



BLACK AND WHITE reproduction fails to reveal the color of this boiler room

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Heat Transmission Coefficient

. . . with two types of insulation

should be considered, depending upon the thickness and the resistance of the air space and whether it is covered on one or two sides with a reflective material. If no air space is present where the reflective material is applied, then obviously there is very little effect due to the reflective material. This is assuming of course that the stud space is filled with mass insulation.—C. E. Lund, Professor of Heating and Ventilating, University of Minnesota.

PAUL D. CLOSE —

"The Method Is Not Complicated"

The method of calculating the overall heat transmission coefficient for a wall with two different types of insulation — mass and reflective — is not complicated.

To make this determination, it is only necessary to add the component resistances of the various materials in the construction. For mass insulations, this is obtained by dividing the thickness by the conductivity.

The resistance for the reflective material may be determined by adding the resistance of the air spaces enclosed by the reflective materials. Thus, if a single sheet of reflective material divided an air space into two air spaces, then the resistance of each of the two air spaces would have to be included. The resistance value of these air spaces depends on a number of factors, including the width, orientation, mean temperature and temperature difference.

The coefficient of transmission or "U" value is then obtained by taking the reciprocal of the sum of the resistances in the construction, including the surface and air space resistances plus the internal resistances of the component materials.—Paul D. Close, Technical Director, Simpson Logging Co.

READER ASKS —

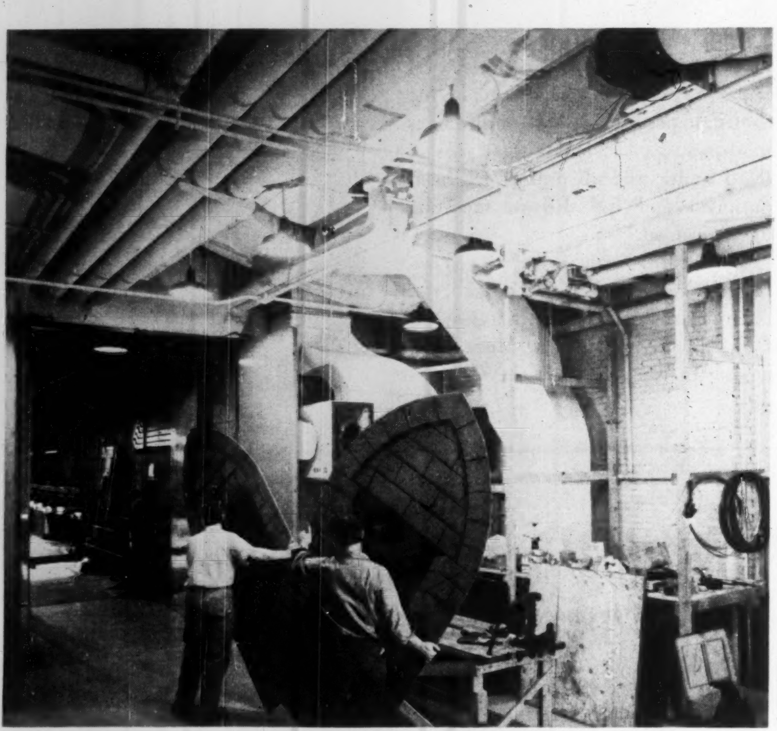
"What's Basis of Maintenance Program for Pressure Reducing Valves?"

"I am looking for information which might furnish a basis for an inspection, overhaul and replacement program covering 30 1 in. pipe size, pressure reducing valves, diaphragm operated, on cold water service. I would like to know how often to open the valves for inspection and about how often, on the average, it would be necessary to replace the diaphragm and the other working parts of the valve." — S.L.H.

[You are invited to comment on this question, giving actual examples if possible. Address the Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.]

New TV Studios Air Conditioned

. . . Units Handle 75,000 cfm of air



AIR HANDLING UNITS are mounted on rubber and installed below the ceiling in the property rooms. They move 75,000 cfm of air

In the new studios of the Dumont television station in Pittsburgh, vast quantities of heat generated by intense lighting and other electronic equipment have to be removed quickly in order to maintain comfortable conditions for entertainers, visitors and employees. At the same time, there can be no distracting sounds from the ventilating equipment.

It was determined that to do the job it would be necessary to circulate over 75,000 cfm of air, according to the Westinghouse Electric Corp. This air is moved and conditioned by 13 air handling units, a surface dehumidifier and three fans.

Selected first for quietness of operation, the units were installed on rubber supports to alleviate vibration interference. In addition, the units were mounted just below the ceiling in property rooms where they occupy no valuable floor space and yet are always accessible.

Each room has its own air handling unit, independently regulated.

High School Heating Costs Reported

. . . for first season

During the first heating season, fuel costs averaged only $500 per month for the new $2.5 million Carlmont high school in Belmont, Calif. Most of the season natural gas was used as the fuel, with a change made to oil only in emergency periods.

The heating method for the 10 one story classroom buildings, which occupy 155,000 sq ft of floor area, is a radiant panel system with ¾ in. pipes embedded in the concrete slab floors. Two low pressure steam boilers, each with a rating of 6,000,000 Btu per hr are installed and were sized to accommodate future expansion of the school, says the National Radiator Co.

Hotel Modernizes Heating By Installing

. . . individual

WORKMEN INSTALLING a new convector in one of the Congress guest rooms. The piping has been concealed behind the baseboard and the convector is being secured in place

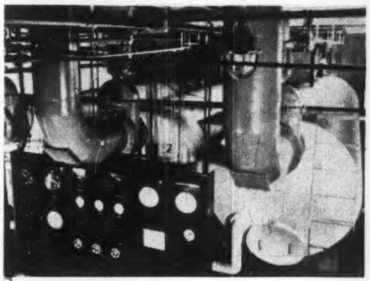
The Congress Hotel, a Chicago landmark, has modernized the heating in an additional block of its guest rooms. Radiators have been replaced with convectors and exposed piping has been concealed in the baseboard.

One hundred and fifty convectors of the wall-hung type have been installed, now making a total of 225 new units installed. The work will continue until all the old radiators have been replaced. In many instances, the convectors have been installed in new locations in the rooms, necessitating additional piping.

The simplified control provided by convector dampers was one of the

Dollars Pulled Out of Air for Plastics Manufacturer

. . . alcohol recovered



THIS ACTIVATED carbon recovery system recovers 2000 gal of denatured alcohol daily

A CINCINNATI manufacturer of laminated plastics literally pulls dollars "out of the air."

Large amounts of alcohol are used by the firm to cut the resin used on paper and other material prior to impregnation and forming. Formerly, this solvent was vented through exhaust stacks and lost to the atmosphere. Now, this solvent laden air is passed through the recovery system at the rate of 21,250 cfm.

Because the phenol-formaldehyde resin could contaminate the system's activated carbon which adsorbs and holds the alcohol vapors, a scrubber was incorporated. This installation paid for itself in one year.

Convectors

damper control

factors in the heating modernization, according to B. E. Nydam, supervising engineer of the Pick Hotels, owners of the Congress. Manually operated, the dampers permit easy control by individual guests.

"Insurance of guest satisfaction was the basic reason for the change," Mr. Nydam said. "The radiators, after long service, did not provide the control, and guests often opened windows to achieve the desired comfort balance."

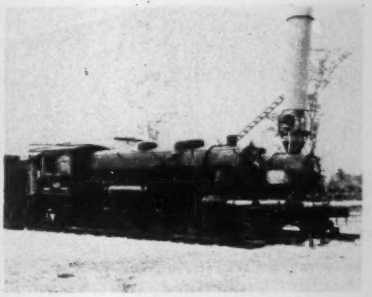
The modernization cost approximately $38.00 per room, plus the cost of the convectors. No changes were necessary in the steam heating system to make the change-over.

Fan Aids Locomotives in Supplying Steam

. . . temporarily for heating

TWO SURPLUS locomotives are used to supply steam for heating to a new area of the greatly expanded Oceana Naval Air Station near Norfolk, Va. When commanding officer Capt. W. S. Butts learned that the planned heating plant would be delayed, he put the two surplus locomotives to work producing steam.

However, a locomotive depends on forward speed to provide draft for its boiler. So the temporary heating plant was equipped with an induced draft fan on one stack and the other one was sealed. This novel arrangement makes up for the lack of draft. This temporary plant will adequately serve the air station until January when the planned heating system will be operating, according to the De Bothezat Fan Div. of American Machine and Metals, Inc.



STEAM FOR HEATING is supplied by these two surplus locomotives until the heating plant is finished and can take on the load.

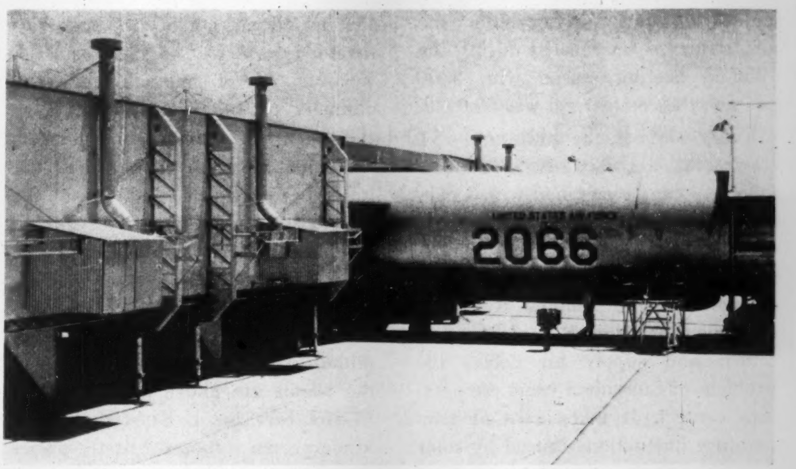
Unit Heaters Serve Mobile Service Docks

. . . for world's largest bomber

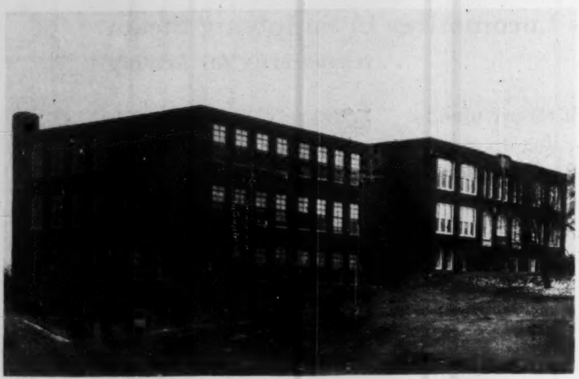
CORRUGATED ALUMINUM service docks with gas fired blower type unit heaters provide wintertime comfort for employees working on the 10 engines of the world's largest bomber, the 179 ton B-36.

Although Convair's plant is the world's largest integrated aircraft plant, it would be impractical to service the huge planes inside. The planes have an overall wingspan of 230 ft and a 162 ft fuselage.

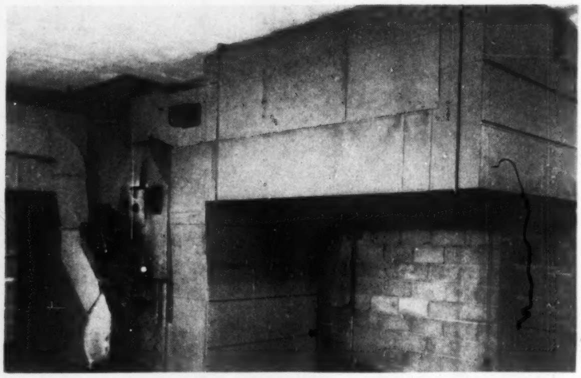
The mobile docks which extend for 60 ft on each side of the wings, are enclosed on three sides, top and bottom with aluminum, and the remaining side has a canvas flap. Almost 100 heaters, each with 450,000 Btu per hr capacity, are in use, reports the Surface Combustion Corp.



UNIT HEATERS in aluminum all-weather service dock surround the 230 ft wingspan of a B-36 bomber on the ramp at Convair's Fort Worth plant. Dozens of these docks are in use at the plant



1 ADDITION TO THE TWINSBURG SCHOOL at the left contains a flexible heating and ventilating system built around a warm air space heater. Fuel oil for the first year cost $499.26



2 OUTDOOR AIR DUCT at the left and the return system feed into the plenum chamber at the left of the heater. A 11,178 cfm fan forces two-thirds of the air through the heater, and the rest (tempered air) into the vertical riser at right of heater

Heat, Ventilate School Addition By Oil Fired Warm Air System

To HEAT the new addition to the Twinsburg school, Summit County, Ohio, a separate recirculating warm air system incorporating an oil fired space heater was chosen, according to the Dravo Corp. It was decided not to enlarge the existing heating system, which consists of five 31 year old, forced warm air furnaces which introduced 100 percent outdoor air for make-up purposes continuously.

Approximately equal in volume to the old building, except lacking an auditorium and a gymnasium, the new structure was heated during the 1952-53 heating season with 5300 gal, and the cost per gal was $0.0942.

Every room in the addition — 11 classrooms, a clinic, rest rooms and toilets — can be supplied with a constant volume of up to 100 percent outdoor air during school hours, more than enough for a complete change every 10 minutes. A unique and inexpensive method of blending return and supply air solves the problem of individual room temperature control. It takes care of temperature fluctuations caused by solar heat gain, lighting, and sensible heat.

The heating plant is shown in Fig. 2. The supply air duct at the left, as well as the return system feeds into the plenum at the left of the heater.

Inside the air chambers are pneumatically operated proportioning dampers that determine the proper mixture of heated and tempered air that is to go through the branch ducts to individual rooms. A pneumatic modulating thermostat in each room controls the proportioning damper to meet room air temperature requirements. The normal position of the damper blade controlling the heated air is "open," and it is throttled back by the thermostat. A separate set of manually adjusted dampers on the branch ducts keep the total air distribution balanced.

Return air from rooms flows out into the corridors and down the stairwell into the plenum mixing chamber or out a roof vent. The proportion returning and that exhausted is determined by the percentage of outdoor air that is admitted. Ducts for delivering air to the rooms are above a false ceiling in each corridor. Exhaust air leaving kindergarten rooms first passes through children's lockers, before being discharged into the corridors. This is in accordance with the Ohio state code. All room exhaust ducts are equipped with safety back pressure dampers.

Control of make-up air is by means of a pneumatic thermostat in the plenum mixing chamber at the left of the heater. This controls the dampers on the outdoor air intake, the return air discharge and the roof exhaust vent. Setting this thermostat at any temperature below that of the return air causes it to adjust the three dampers to maintain the ventilation rate.

Modulating control of the heater is through a thermostat mounted in the heater outlet duct. With this method of control, daytime operation is such that the required amount of outdoor air is admitted, the heater maintains a set heated air temperature and the individual room thermostats control their mixing dampers to deliver air into the rooms at the required temperature. For night operation a throw-over selector switch on the heater panel puts all control on an electrical thermostat in the stair well. Heater and fan then operate intermittently to maintain temperature, and 100 percent of the air is recirculated.

How to Find Heat Transfer from Plastic Panels

IN ORDER TO determine the overall coefficient of heat transfer through a Plexiglas panel or tank, the alignment chart on the following page may be used with sufficient accuracy for engineering calculations, according to the plastics department of Rohm & Haas Co. To use the chart, locate the air velocities at each surface of the panel on scales (1) and (2); then locate the point on scale (3) which is determined by the intersection of a straight line drawn between the chosen point on scales (1) and (2). This point on scale (3) is then lined up with the point on scale (4) corresponding to the sheet thickness, and the coefficient is read from scale (5). Multiplying this coefficient by the temperature difference between the air or fluid at each surface, and by the area in sq ft will give the number of Btu's transferred through the panel or tank per hr.

Example 1

Problem: What is the rate of heat loss from a 0.125 in. thick Plexiglas window with zero air velocity on the inside and a 20 mph wind on the outside, the air temperature difference being 60 F and the area of the window 12 sq ft.

Solution: Lay a straight edge between the zero mark on scale (1) and the 20 mph mark on scale (2) intercepting scale (3) at 0.77. Then lay the straight edge from this point on scale (3) to the 0.125 in. mark on scale (4). The coefficient 1.15 is read from scale (5).

The rate of heat loss can be calculated as 1.15 × 60 × 12 = 828 Btu per hr.

The chart may also be used if the temperature drop between the surfaces of the panel itself is known rather than the drop from air on one side to air on the other. In this case the zero mark on scale (3) is lined up with the sheet thickness on scale (4) and the coefficient again read from scale (5). In this case the coefficient will represent the heat transferred per F of temperature drop across the panel only, per sq ft per hr.

Example 2

Problem: A tank made of ½ in. thick Plexiglas panel has 13 sq ft of wall area. It is used to hold water at 120 F. The temperature of the outside of the tank is found to be 100 F. What is the rate of heat loss?

Solution: The inside surface of the plastic panel may be assumed to be at the same temperature as the water, so the temperature difference of 20 F exists across the panel. Line up the straight edge between the zero mark on scale (3) and the 0.5 in. thickness mark on scale (4). The point of intersection with scale (5) determines the coefficient of heat transfer; in this case, 2.6 Btu per hr per sq ft per F.

The rate of heat loss can then be calculated as 2.6 × 20 × 13 = 676 Btu per hr.

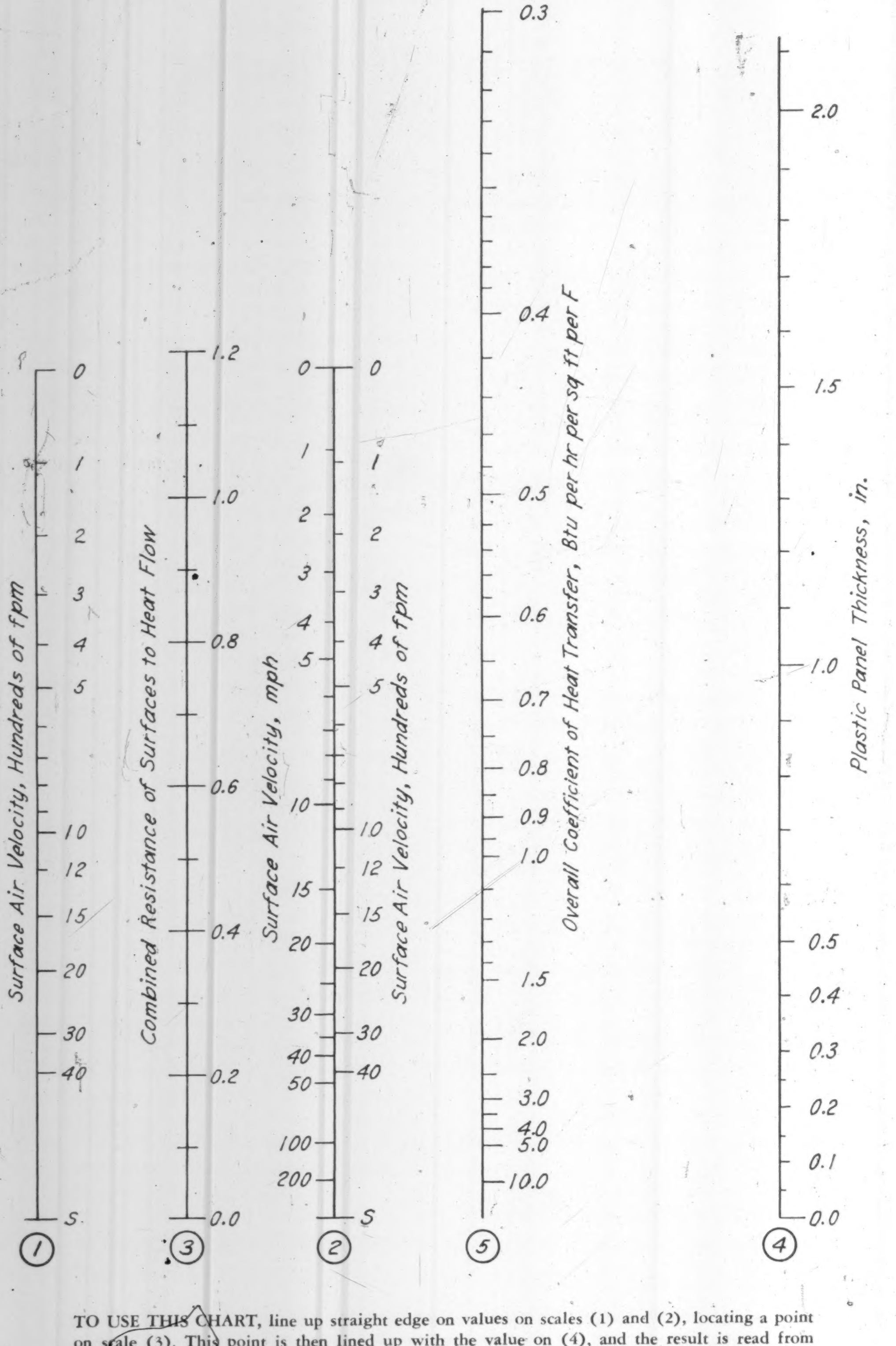
The chart may also be used where the temperature of one surface of the panel is known and the air temperature beyond the other surface is known. In such a case, the straight edge is set at a point on scale (1) or (2) corresponding to the air velocity on the side of which the temperature of the air is known. The straight edge is set at *S* on the other scale (2 or 1), and the intercept on scale (3) determined as before. This intercept is used together with the thickness point on scale (4) to determine the coefficient from scale (5).

Example 3

Problem: The tank in example 2 is surrounded by air at 70 F, which is not moving. The water is at 120 F. Find the heat loss.

Solution: This time, the straight edge is lined up between zero air velocity on scale (1) and *S* on scale (2), and the value 0.59 is determined on scale (3). This point is lined up with the 0.5 in. mark on scale (4), and a coefficient of 1.05 is read from the intercept with scale (5).

Then, the rate of heat loss value can be calculated to be 1.05 × 50 × 13 = 683 Btu per hr.



TO USE THIS CHART, line up straight edge on values on scales (1) and (2), locating a point on scale (3). This point is then lined up with the value on (4), and the result is read from scale (5).

Heating, Piping & Air Conditioning

THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

JOURNAL SECTION

The object of the Society is to advance the arts and sciences of heating, ventilating, cooling and air conditioning, and the allied arts and sciences, for the benefit of the general public, to encourage and conduct scientific research, and to cooperate with other organizations having the same or similar objectives.

Effects of Weather Conditions on Cooling Unit Operation in a Residence†

By H. T. Gilkey*, W. S. Stoecker, and S. Konzo‡, Urbana, Ill.**

SUMMARY — This is the second report of a continuing investigation of summer cooling conducted in Warm Air Heating Research Residence No. 2. The results show that greater removal of moisture from the air occurred when the blower cycled with the compressor than when the blower operated continuously. This occurred despite relatively dry outdoor conditions during the period of cyclic blower operation. Increasing the air-flow rate through the cooling unit from 600 to 800 cfm resulted in only a 7 percent increase in cooling unit capacity. Time of compressor operation during a 24-hr period was found to be a function of mean daily outdoor temperature. The datum mean daily temperature above which compressor operation occurred was approximately 65 F. The velocity and temperature patterns of the air entering the room from a high sidewall register were studied. A discussion of variations in summer weather from year to year is included.

AS A PART of the cooperative project sponsored jointly by the Engineering Experiment Station of the University of Illinois and the *National Warm Air Heating and Air Conditioning Association*, investigations of summer cooling were conducted in Warm Air Heating Research Residence No. 2 during the summers of 1952 and 1953. A portion of the investigation conducted in Research Residence No. 2 during the summer of 1952 has been reported previously[1].

The principal objectives of the investigation reported in this paper were:

1. To determine the effect of continuous and cyclic blower operation upon the air temperature and humidity conditions in the Residence.
2. To determine a rational basis for estimating the hours of compressor operation during the summer season.
3. To determine the velocity and temperature patterns of the air stream issuing from a high wall supply register.
4. To determine the effect on compressor performance of increasing the air-flow rate from 300 cfm per rated ton to 400 cfm per rated ton of refrigeration.

Research Residence No. 2

The Residence, shown in Fig. 1, is a one-story structure of frame construction with a large amount of glass exposure and with a full basement. The calculated coefficient of heat transmission, U, for the insulated exposed wall section is 0.07 Btu per (hr) (sq ft) (F deg). All windows and doors are weatherstripped and the windows on the east and west exposures are equipped with

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† This investigation was a part of the cooperative project jointly sponsored by the Engineering Experiment Station of the University of Illinois and the *National Warm Air Heating and Air Conditioning Association.*

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[1] Exponent numerals refer to References.

JOURNAL SECTION

canvas awnings. Except for one large picture window in the living room, which was fixed in place and consisted of two panes, the windows are single glazed and of the horizontal sliding type. Doors are of conventional wood and glass construction. The south exposure of the Residence is shaded by a 3-ft 10-in. roof overhang. For this summer cooling investigation, the ceiling joist space was filled with 5 in. of mineral wool insulation, and the calculated coefficient of heat transmission is 0.07 Btu per (hr) (sq ft) (F deg).

The conditioned space consisted of all first-story rooms. Table 1 gives a summary of the room dimensions and volumes. The heat gain calculations, made in accordance with Manual No. 11[2] of the *National Warm Air Heating and Air Conditioning Association,* were based on outdoor design conditions of 95 F dry bulb and 76 F wet bulb, and an indoor dry-bulb temperature of 75 F. The design sensible heat gain on a design day for the structure was 21,090 Btu per hr. The Residence was completely furnished but unoccupied during this investigation.

Table 1—Data for Research Residence No. 2

Heat Transmission Coefficients, Btu per hr (sq ft) (F)	*U*
Insulated Frame Wall, with 3-⅝-in. mineral wool insulation	0.07
Insulated Ceiling, with 5-in. mineral wool insulation	0.07
Outside Door — Front Hall	0.51

Room	Dimensions Ft	In.		Ft	In.	Ceiling Area[a]	Exposure	Net Wall Area	Glass Area	Volume
Living Room	21	10	×	13	4	308	East	117	—	2,480
							South	89	100[b]	
South Bedroom	13	4	×	11	0	169	South	71	28	1,325
&	4	0	×	2	3		West	93	25	
South Bedroom Closets (2)	4	6	×	1	11	23	South	19	—	147
Bath	7	8	×	4	11	44	West	36	11	320
North Bedroom	11	11	×	10	4	135	West	66	25	1,050
							North	61	30	
North Bedroom Closet	5	10	×	2	4	18	North	24	—	116
							East	37	—	
Hall to Bath	6	7	×	5	2	43	—	—	—	289
Front Hall	11	6	×	4	7	59	North	22	21 (door)	448
Front Hall Closet	4	0	×	2	4	9	—	—	—	79
Kitchen-Dinette	19	0	×	11	4	232	North	124	42	1,830
							East	89	12	
Total First Story						1,040	—	848	273	8,084

[a] Ceiling area includes area of partition and exterior walls.

[b] South Living Room glass area includes area of outside door having a high glass to wood area ratio. Double glazed picture window has area of 27 sq ft.

Note: Ceiling Height of First Story — 8 ft 6 in.

Cooling Unit: The cooling unit, shown in Fig. 2, was one of two sections of a year 'round air conditioner which was installed in the basement and described in a previous paper[1]. Return air entered the unit and passed downward through the filter and evaporator coil, both of which were in a horizontal plane. The pan for collecting the water condensed out of the air was located beneath the evaporator coil. The coil and blower were in an insulated compartment and were isolated from the compressor and condenser, which were located in the lower part of the unit. Refrigeration capacity of the unit was 23,800 Btu per hr with *ASRE* standard inlet-air conditions and at a rated air delivery of 900 cfm and 120 psi refrigerant head pressure. The semi-hermetic compressor was directly connected to the 220 volt, single-phase, 2 hp motor. Both the motor and the shell-and-tube type condenser were water cooled. Refrigerant was dichlorodifluoromethane.

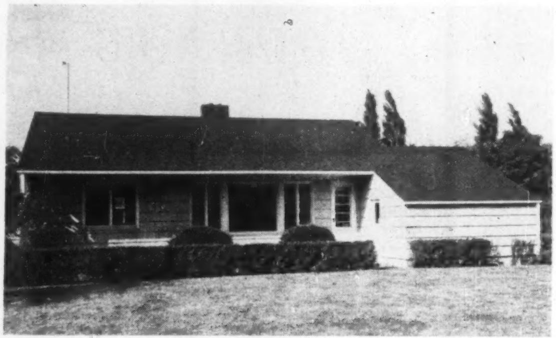

Fig. 1—South view of Research Residence No. 2

Duct System: The duct system was the same used previously in both heating and cooling investigations; it was of the extended plenum type, having uniformly sized trunk ducts leading from the furnace bonnet toward the east and west ends of the basement. Branch ducts were connected to the top or side of the trunks and were unchanged in size from the trunk take-off fitting to the register stackhead. All registers in the first-story rooms were at the high-sidewall location, 6½ ft from the floor, with the exception of the baseboard register in the front hall near the door. Fig. 3 shows the first-story plan and the register locations. All return-air intakes were located in the baseboard. The system was designed for heating only in accordance with Manual No. 7[3] of the *National Warm Air Heating and Air Conditioning Association.*

Instrumentation: Approximately 180 thermocouples of 24-gage copper-constantan wire were installed for temperature measurements. Thermocouples were placed at four different levels (floor, sitting, breathing, and ceiling) on standards located near the centers of each of the first-story rooms and at three stations in the basement. The locations of the temperature measuring stations in the first-story rooms are shown in Fig. 3. Thermocouples were also installed in the ceiling and floor surfaces, on the surfaces and within the exterior walls, in the attic, in the duct system, and at other desired points inside and outside the Residence. Each thermocouple was connected through switches to an indicating potentiometer. It was possible to obtain a continuous record of any 18 of the 180 thermocouple stations by means of recording potentiometers.

Heat-flow meters were installed at various locations in the house. One meter was installed in each of the outside walls 60 in. from the floor, and was located on the exterior surface of the interior panels and next to the insulation. One was placed above the ceiling, between the top ceiling surface and the attic insulation. Meters were also located on the underside of both the north and south slopes of the roof.

Continuous records were made of the outdoor-air temperatures, both dry and wet bulb, the indoor relative humidity, the wind velocity, and the intensity of solar radiation received on a horizontal plane. Wind direction was noted at frequent intervals.

Operating Conditions

Three series of studies were conducted, all with an air-flow rate of 800 cfm, or approximately 400 cfm per rated ton of refrigeration. This was in contrast with 300 cfm per rated ton used in the studies[1] of 1952. No ventilation air was mechanically introduced during any of the 1953 studies, and the Residence was kept closed at all times. The indoor dry-bulb temperature was controlled at 75 F, but no attempt was made to control the indoor relative humidity.

The three series of studies conducted in 1953 were identified as follows:

Series S53-1: The blower was operated continuously. The Residence was not occupied and no moisture was released indoors.

Series S53-2: The blower was operated continuously. For the purposes of imposing a definite latent load, the following weights of water were vaporized by means of electric vaporizers: 1.0 lb in 30 min. beginning at 7:00 a.m., 1.25 lb in 1 hr beginning at 11:30 a.m., and 2.25 lb. in 2 hr beginning at 5:00 p.m.

Series S53-3: The blower was cycled with the compressor. The latent load addition was the same as for *Series S53-2.*

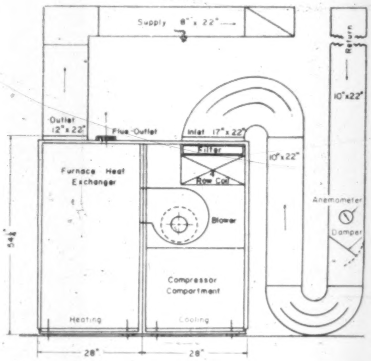

Fig. 2 — Furnace and cooling unit

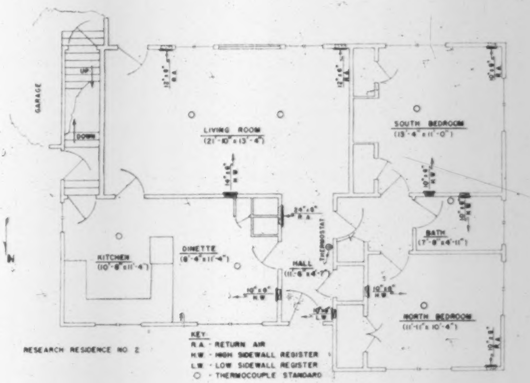
GARAGE
UP
DOWN
LIVING ROOM (21'-10" x 13'-4")
SOUTH BEDROOM (13'-4" x 11'-0")
KITCHEN (10'-8" x 11'-4")
DINETTE (8'-6" x 11'-4")
HALL
THERMOSTAT
BATH (7'-8" x 6'-11")
NORTH BEDROOM (11'-11" x 10'-4")
RESEARCH RESIDENCE NO. 2
KEY:
R.A. - RETURN AIR
H.W. - HIGH SIDEWALL REGISTER
L.W. - LOW SIDEWALL REGISTER
O - THERMOCOUPLE STANDARD

Fig. 3—Floor plan of Research Residence No. 2

Effects of Blower Operation

Increase in Air-Flow Rate: In 1952 the measured capacity of the condensing unit was 20,300 Btu per hr with an air-flow rate of 300 cfm per rated ton of refrigeration. In these studies, a 33 percent increase in the flow rate of the circulating air to 400 cfm per ton resulted in a measured capacity of 21,700 Btu per hr, a 7 percent increase. The fact that the measured capacity was still below the rating of the unit was attributed largely to the return-air temperature, which was lower than that used for rating the condensing unit. Other deviations in operating conditions from *ASRE* standard conditions caused the remainder of the discrepancy.

With an air-flow rate of 800 cfm the total pressure in the supply plenum at the exit of the year 'round conditioner was 0.21 in. of water column and that at the return-air plenum was 0.19 in. of water column, or 0.40 in. for both sides. These values are approximately double those used in the original design of the duct system. An air-flow rate of 340 cfm was used to heat the first story only. When the basement was heated, an air-flow rate of 565 cfm was used for both the basement and the first story, and the extended plenum was sized for this condition.

Indoor Humidity Ratios: Although higher outdoor humidity ratios can be expected to occur with higher values of mean daily outdoor temperature, the variation which exists is indicated by the spread of points on the left hand plot of Fig. 4. In general, the trend of the observed data shows that on hot days a higher moisture load can be expected than on cool days. The points indicated by the solid circles show that for a majority of the 15 days during which the blower was cycled with the compressor (*Series S53-3*), the outdoor air was relatively dry.

The plot on the upper right portion of Fig. 4 shows that on hot days more moisture was removed by the evaporator coil than was removed on cool days. The solid circle points, representing data for cyclic blower operation, were predominantly near the upper range of observed points. Thus, in spite of the fact that the tests were conducted during a dry spell, the total amount of moisture removed was relatively large. The majority of the points represented by the open circles (*Series S53-2*) were higher than those represented by crosses (*Series S53-1*). This would indicate that the release of 4.5 lb of moisture within the house (*Series S53-2*) resulted in a larger amount of condensation during the day.)

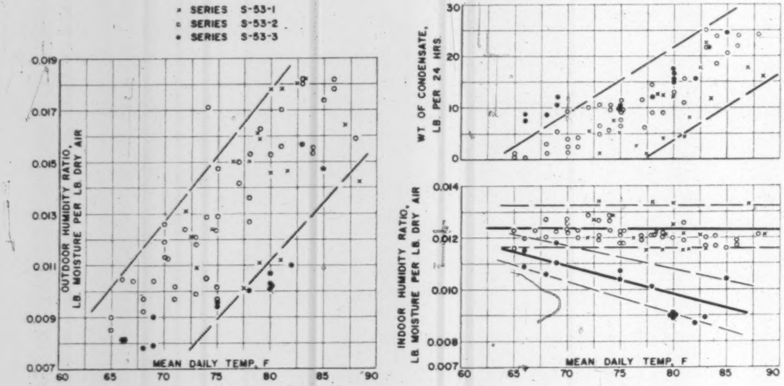

Fig. 4—Humidity ratios and weight of condensate

Indoor humidity, as represented by the humidity ratio, is shown by the plot on the lower right of Fig. 4. For both series of tests during which the blower operated continuously (*Series S53-1* and *S53-2*), the indoor humidity ratio was practically constant regardless of the outdoor temperature. This average humidity ratio was about 0.0123 lb of moisture per lb of dry air and corresponds to a relative humidity of 66 percent at a temperature of 75 F. In other words, with larger moisture loads arising either from more humid outdoor air or a larger moisture release indoors, a larger amount of condensation occurred.

Blower Cycled with Compressor: Although the most common method of blower operation has been to operate the blower continuously, the suggestion has been made that better humidity control might be achieved if the blower were cycled with the compressor. The underlying theory is that if the blower ceases to operate when the compressor stops, the moisture condensed on the cooling coil will not be re-evaporated. The humidity of the room air would not be increased by this re-evaporation, as it would when the blower is operated continuously.

The data shown in the lower right side of Fig. 4 for cyclic blower operation (*Series S53-3*) indicated that on a hot day the indoor humidity ratio was lower than on a cooler day. This may only be accounted for by the longer operating time of the compressor on a hot day, with the consequent larger condensation of moisture, and the absence of re-evaporation from the wet coils during periods when the compressor and blower were not operating. The difference between the curve representing continuous blower operation and that for cyclic blower operation is sufficiently large that it cannot be attributed merely to differences in weather conditions during the two studies. It might be expected that the indoor humidity ratio was lower for this type of operation as a result of the lower outdoor humidity ratio experienced during this series. It should be noted, however, that the weight of condensate collected during the period with cyclic blower operation was higher than the mean for the entire investigation, but that on days of high mean daily temperature the weight of condensate was within the range experienced with continuous blower operation. The practical implication of the results is that cyclic operation of the blower in conjunction with the compressor gives a larger reduction in humidity ratio than does continuous operation, especially in hot weather. Nevertheless, it would be expected that the weight of condensate collected would be the same for the two methods of blower operation for identical days on which the compressor operated continuously.

A comparison of the two methods of blower operation is shown in Fig. 5. The examples shown are from noon to 2:00 p. m. on two days when similar outdoor temperatures and humidities were experienced, as shown by the outdoor dry-bulb and wet-bulb temperatures. The indoor air conditions were measured in the return-air plenum at a point just upstream from the point where the air entered the cooling unit. With continuous blower operation, shown on the left side of Fig. 5, the indoor wet-bulb temperature increased

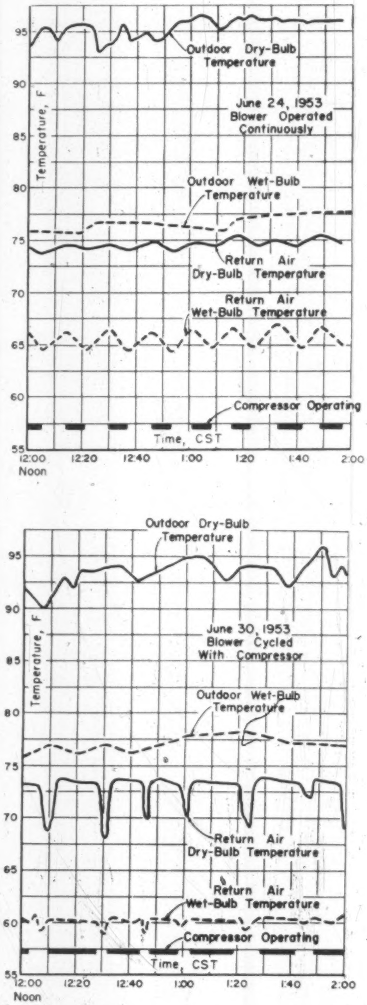

Fig. 5—Indoor air conditions with two methods of blower operation

Table 2—Weather Records for the Years 1935 Through 1938[a]

Item	Season			
	1935	1936	1937	1938
Number of Days at 85 F or over	55	81	61	54
Number of Days at 90 F or over	19	50	23	16
Total Hours above 85 F	23	706	302	204
Total Hours above 90 F	83	342	40	23
Total Degree-Hours above 85 F	1082	4551	862	535
Total Degree-Hours above 90 F	174	1963	64	23

[a]From weather records obtained at Research Residence No. 1 in Urbana, Ill.

References: University of Illinois Engineering Experiment Station Bulletins No. 305, p. 64, and No. 321, p. 22.

slightly with each compressor cycle. With cyclic operation of the blower, shown on the right side of Fig. 5, considerably lower return-air wet-bulb temperatures were experienced. The sharp decreases in dry-bulb and wet-bulb temperatures, shown on the right hand charts, after the blower stopped operation have been attributed to the proximity of the recording thermocouples to the cooling coil, although an air filter did serve to shield the thermocouples from the cool evaporator coil.

Although cycling the blower with the compressor would seem to be desirable from the standpoint of lower indoor humidity and lower operating cost of the blower, the possibility of discomfort due to lack of air circulation during the off-periods of the blower must be considered. Unfortunately, this is a subjective matter, which is difficult to evaluate in this type of investigation.

Variability of Weather

From a practical standpoint the most difficult estimate that must be made for the summer cooling of residences is the number of hours of operation of the cooling unit. Once such an estimate is established for a given residence, the electrical power consumption and water consumption can be readily computed. In view of the interest in the subject, a brief discussion is presented of the inherent obstacles confronting those attempting to arrive at a reasonable estimate of the operating times for a season.

In previous publications[5,6] extreme variability of the summer weather was shown to exist. For example, during the four-year period of 1935 to 1938, the values given in Table 2 were tabulated from the weather records at Research Residence No. 1. It is true that the summer of 1936 was the hottest summer in the history of the local weather bureau, but in more recent years the summers of 1952, 1953, and 1954 have approached the severity experienced in 1936. Regardless of the indices used to express the severity of the summer weather, the fact remains that the numerical values of the indices did vary more than 100 percent from the maximum values. This is in decided contrast with winter heating experience, in which the number of degree-days for any season does not vary more than about 25 percent from the maximum values, and not more than about 15 percent from the mean value for the locality. In other words, estimates of fuel consumption for the heating season based on the mean value of the degree days can be made with some assurance that the estimates will be reasonable for at least three years out of four. For summer cooling, however, where the indices of weather severity can vary as much as 100 percent or more from one season to the next, some question exists whether the mean value for a period of years will be entirely satisfactory. The suggestion is offered that a statistical analysis should be made and that any value finally selected for a given locality should not be exceeded more often than one summer out of four. No such analysis has been made for any locality, primarily because no agreement has been reached on the index to be used for evaluating the summer weather.

A comparison of the weather experienced during the 1952 and 1953 cooling seasons with the mean conditions experienced from 1927 to 1937 inclusive is shown in Fig. 6. For example, in 1953 there were a total of 10 days on which the mean daily temperature was 82 F. In a season typical of the 11-year mean, however, one would find only three days having this mean temperature.

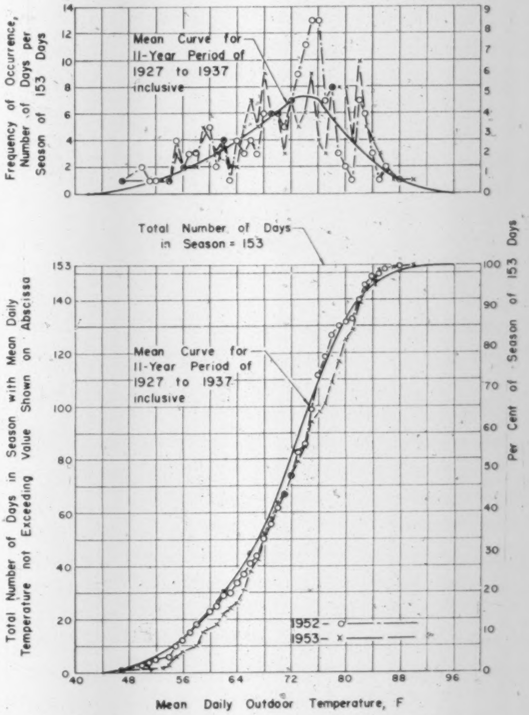

Fig. 6—Frequency of occurrence of days having stated mean daily temperatures

It can be noted further from the lower curve in Fig. 6 that the number of days during the 1953 cooling season upon which the mean daily temperature did not exceed 65 F was 31, and that this mean daily temperature was exceeded on 122 days. Thus, as will be shown later, the compressor would have operated on 127 days (122 days during which $t_m > 65$ F, plus 5 days during which $t_m = 65$ F) out of the 153 days from May 1 to September 30, 1953.

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Indices of Weather

In earlier studies made in Research Residence No. 1 during the years of 1932 to 1939, numerous attempts were made to correlate the number of hours of compressor operation with some index of weather condition. Obviously, as the daily outdoor temperature increases, longer hours of compressor operation can be expected. The problem is not as simple as stated, even for a given residence, since no single index of weather conditions can take into account such variables as: (1) intensity and duration of maximum outdoor dry-bulb temperature; (2) intensity of outdoor dry-bulb temperature during the hours preceding the maximum outdoor temperature; (3) magnitude of the outdoor humidity ratio during the day; (4) the duration and intensity of solar radiation; and (5) moisture release and heat release within the residence. In spite of the difficulties, however, it becomes of great practical interest to determine some relatively simple index of weather conditions that might serve as a correlation for compressor operation.

The number of degree hours above 85 F, shown in Table 3, was used in the earlier studies, and was found to be one index which could be used to correlate the number of hours of plant operation. The differences in the constructions of Residences Nos. 1 and 2, as well as the lower setting of the room thermostat now being recommended, have shown that a lower base temperature than 85 F should be used for determining the degree hours. For example, in the early thirties, when thermal *shock* was considered to be a possible source of discomfort, the setting of the room thermostat was at the upper limit of comfort, namely between 78 F and 80 F. In current practice, a setting of 75 F is commonly recommended. This small difference of 3 F in the setting of the room thermostat will affect to a considerable extent the number of hours of compressor operation, since in general, the rate of rise of room-air temperature in a residence may be as low as ½ to 1 deg per hr without cooling. Furthermore, the rooms in a one-story house of current construction with relatively larger glass area, will require more cooling and at an earlier hour than the first-story rooms of a multiple-story residence with smaller glass area. In addition, the extent to which night-air cooling is employed will also affect the starting time of the cooling, and hence the total hours of operation each day.

Compressor Operation

The studies conducted during the summer of 1953 are summarized in the three plots shown in Fig. 7. The lower set of curves shows the relationship between the hours of compressor operation and the number of degree hours above a base temperature of 65 F for each day. The degree hours were determined only for the period during which the outdoor air temperature exceeded the 65 F value for each day. In other words, unlike the degree day determinations for winter heating, the mean daily temperature for the day is not used in determining the degree hours above 65 F. The lower set of curves in Fig. 7 shows good linear correlation between compressor operation and degree hours above 65 F, perhaps better than the correlations obtained with either the maximum daily temperature or the mean daily temperature, shown in the two upper sets of curves. From the standpoint of industry-wide application, however, the degree hour index is not as convenient as one based on a simpler scheme. For any given locality difficulty will be experienced in obtaining degree hour data over a period of at least 10 years.

The simplest correlation is that shown at the top of Fig. 7, in which the hours of compressor operation have been plotted against the daily maximum outdoor air temperatures. A fair correlation is obtained. Unfortunately, the daily maximum air temperature ignores the preceding history of the weather. In other words, the load on the plant will be affected by the air temperatures preceding the time when the maximum is attained.

In the middle set of curves shown in Fig. 7, the mean daily temperature has been selected as the criterion of weather and the correlation with compressor operation is shown to be better than that shown in the upper set of curves. In this case, the mean daily temperature is based on the numerical average of the maximum outdoor temperature and the

Table 3—Weather Data and Estimated Compressor Operation *(Based on 153-day period from May 1 to September 30, 1953)*

	May	June	July	Aug.	Sept.	Total
Weather Data						
Number of days at 85 F and above[a]	6	21	22	18	12	79
Number of days at 90 F and above[a]	3	17	11	11	7	49
Number of days at 95 F and above[a]	0	5	3	9	5	22
Number of days of mean daily temperature 65 F and above	15	30	31	31	22	127
Number of degree days for cooling[b]	94	372	352	305	149	1,272
Estimated Consumption with Cyclic Blower Operation						
Estimated compressor Operation, hr	58	205	197	175	92	727
Estimated electrical consumption, kwhr						
Compressor	116	410	394	350	184	1,454
Blower[c]	19	66	63	56	29	233
Total	135	476	457	406	213	1,687
Estimated water consumption, gal	8,600	30,300	29,100	25,900	13,600	107,500
Estimated Consumption with Continuous Blower Operation						
Estimated electrical consumption, kwhr						
Compressor	116	410	394	350	184	1,454
Blower[d]	100	230	238	238	169	975
Total	216	640	632	588	353	2,429
Estimated water consumption, gal	8,600	30,300	29,100	25,900	13,600	107,500

[a] The temperatures refer to maximum daily temperatures, and not to mean daily temperatures.

[b] Degree days per day equals the difference between the mean daily temperature and 65 F. Mean daily temperatures below 65 F are not considered.

[c] The blower electrical consumption is based on cyclic blower operation during compressor operation only.

[d] The blower electrical consumption is based on 24-hr blower operation on days in which mean daily temperature exceeds 65 F.

minimum outdoor temperature during the preceding morning hours only. In this respect, the mean daily temperature as commonly given by the Weather Bureau is slightly at variance since the minimum temperature is not always restricted to the hours preceding the occurrence of the maximum temperature.

From a practical standpoint, therefore, the mean daily temperature (or its equivalent, which is the degree days above some base temperature) is probably the best compromise index for use in determining hours of compressor operation. The results will not be as close as those based on degree hours above 65 F, but the advantage of easy determination of the index will more than offset the loss in accuracy. Furthermore, since the variation in degree days from one season to the next is extremely large, precision in method is not as necessary as simplicity.

The results reported in a study of the operating costs of 11 homes[7] indicated that the temperature basis for defining the cooling degree day should be 70 F. However, the results of the studies conducted in Research Residence No. 2 indicated that the temperature base should be approximately 65 F. In both the studies of Gilman and in Research Residence No. 2, the indoor-air temperatures were approximately the same, but in the Residence No. 2 studies the house was not occupied. It would be expected that occupancy would have the effect of lowering the datum temperature, and yet the results indicated that the datum for Residence No. 2 was 65 F despite its unoccupied condition. As was necessary in the establishment of the base temperature for winter heating, it is probable that a large number of installations should be studied before a generally acceptable base temperature for summer cooling can be determined. The possibility exists that the base temperature for one-story houses will be lower than that for two-story houses, and will be different for houses subjected to night-air cooling, and that a compromise value will eventually be necessary for practical applications.

It should be realized that the curves in Fig. 7 are based upon a ratio of calculated heat gain to rated cooling unit capacity of 1.15. Lower values of this ratio, which would mean a larger cooling unit capacity, would cause the curves to have smaller slopes, indicating fewer hours of compressor operation. It is not anticipated, however, that changing this ratio would affect the datum mean daily temperature for the Residence.

The calculations in Table 3 were made from the weather records (between May 1 and September 30, 1953) and from the average curve shown in the middle set of curves in Fig. 6. The hours of compressor operation for this 153-day period were estimated as 727 hours. Based upon power consumptions of 2 kw for the compressor, 0.32 kw for the blower, and water consumption rates of 148 gph, the estimated total consumptions were 1454 kwhr for the compressor motor, 233 kwhr for the blower motor, and 107,500 gal of water.

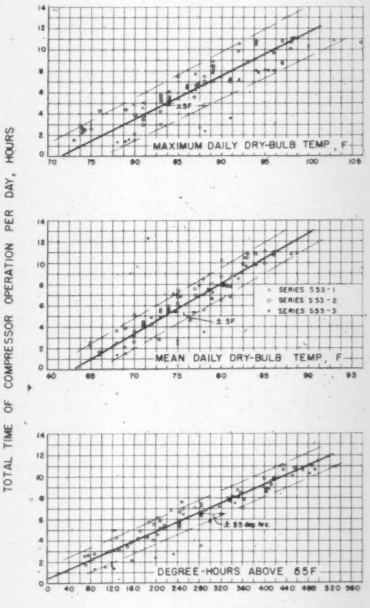

Fig. 7—Compressor operation as related to various outdoor temperature conditions

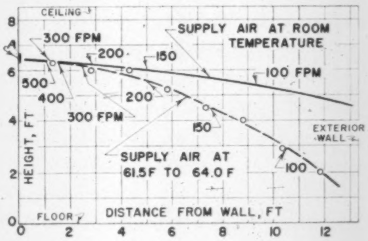

Fig. 8—Velocity pattern of jet from west side of living room register, with 14-in. × 6-in. sidewall register at point A

Air Distribution in Living Room

Studies of systems using perimeter introduction of air through floor registers[8] show that room-air velocities remain below 32 fpm except immediately above the supply outlets. Other investigators[9] have found that it is difficult to eliminate the gravitational effects of the air when high sidewall registers designed for heating are used for cooling.

During *Series S53-2*, a study of the air pattern leaving the living room register was conducted. The 14-in. × 6-in. double-deflection register was located 78 in. above the floor in approximately the center of the north living room wall. The vertical vanes in the register face were set for a 22 deg horizontal deflection of each jet. The rear vanes were set for slight downward deflection. This setting would normally be used for heating so that the warm, low density air would not impinge upon the ceiling surface.

The center of each jet issuing from the register was located both when the compressor was operating (supply-air temperatures between 61.5 and 64.0 F) and when the compressor was not operating, (supply-air temperature approximately equal to room-air temperature). In each case the average air velocity at the register face was approximately 500 fpm.

The elevations of the jets from the west side of the register are shown in Fig. 8. The supply air temperature had a decided effect upon the height of the jet as it moved across the room. When the supply air was at room-air temperature, the center of the jet was about 5 ft above the floor at a distance of 12 ft from the wall in which the register was located (1 ft 4 in. from the exterior wall). When the compressor was operating and the supply-air temperature was lower than room-air temperature, however, the center of the jet was only 2 ft above the floor at the same location. In order to reduce the drop of air into the living zone, it would be necessary to use upward deflection settings on high sidewall registers when used for summer cooling.

The temperature of the supply air had very little effect upon the horizontal throw from the register. In each case, the plan view of the jets was a straight line extending out toward the corners of the room until the velocity was reduced below 100 fpm. At this point the jet turned toward the exterior wall of the room.

Conclusions

The air conditioning system discussed in this paper consisted of a year 'round air conditioner which contained a 2-hp mechanical condensing unit and a duct system designed only for winter heating. Registers were located in the high sidewall location on the interior walls of the rooms. The total air-flow rate was approximately 800 cfm. Studies were conducted both with continuous blower operation and with the blower cycled with the compressor.

Actual capacity of the cooling unit was found to be approximately 21,700 Btu per hr, an increase of 7 percent over that experienced with an air-flow rate of 600 cfm in an earlier investigation. The pressure loss in the duct system was 0.40 in. water column, approximately twice that experienced with the winter air-flow rate of 340 cfm. The air delivered from the high sidewall register into the living room was found to drop into the living zone. This was more pronounced when the compressor was operating and the supply-air temperature was low than it was when the compressor was not operating. The register was adjusted for winter heating and gave a slight downward deflection to the air.

Cycling the blower with the compressor produced lower room-air humidities than did continuous blower operation. Even during periods of low outdoor humidity, the amount of water condensed from the air circulated through the cooling unit was greater with cyclic blower operation than it was in more humid weather with continuous blower operation. Although cycling the blower with the compressor would seem to be desirable from the standpoint of lower indoor humidity, the possibility of discomfort due to lack of air circulation when the blower is not operating must be considered.

Great variation of the climatic factors which affect cooling unit operation can be expected from one season to another. The number of days which have a maximum outdoor temperature equaling or exceeding a given value during one season may be 100 percent greater than the number of days during which the same condition is equalled or exceeded in the following season. The variation in weather conditions is much greater for cooling than for heating. Although it is important that some relatively simple index of weather conditions which would serve as a basis for predicting compressor operation be determined, the index should be determined statistically so that predicted operating times will not be exceeded for at least three years out of every four.

Excellent correlation was found between hours of compressor operation per day and the number of degree hours above 65 F. From a practical standpoint, however, this criterion is not as good an index as degree days based on mean daily temperature. In addition, there was good correlation between hours of operation and mean daily temperature. The datum mean daily temperature above which compressor operation occurred was 65 F. The base temperature for cooling degree days must be determined from investigation of many residences, however, and it may vary depending upon the locality and type of residence.

Acknowledgments

This paper reports one phase of a comprehensive investigation conducted in Warm Air Heating Research Residence No. 2 under the terms of a cooperative agreement between the *National Warm Air Heating and Air Conditioning Association* and the *Engineering Experiment Station of the University of Illinois*. These results will ultimately comprise part of a bulletin of the Engineering Experiment Station.

Acknowledgment is made to the manufacturers who cooperated by furnishing equipment used in the investigation.

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Gas Is an Important Factor in the Thermal Conductivity of Most Insulating Materials[†]

Part II[*]

By R. M. Lander[**], Minneapolis, Minn.

SUMMARY — In Part I of this research paper data were presented showing the reduction in thermal conductivity caused by removing practically all of the air in or around samples of various insulating materials in common use. In that part also some information was given showing the effects of removing only part of the air from these samples.

This present paper (Part II) describes a continuation of the same study, using the same test apparatus and materials. Here are the data showing how the thermal conductivity is reduced when the air in or around the samples is removed and then replaced (partially or completely) by gases having a larger molecular weight than air, such as carbon dioxide and dichlorodifluoromethane. The reductions in thermal conductivity vary considerably, and in some cases amount to approximately 50 percent.

THE THERMAL conductivity of insulating materials is dependent upon four modes of heat transfer: gas conduction, convection, radiation, and solid conduction. Although the general principles relating to each of these modes of heat transfer are fairly well understood, their combined effect on heat transfer through insulating materials is very complicated. Since insulating materials are composed largely of gas, the mechanism of heat transfer through the gas has an important influence on the overall conductivity coefficient.

The thermal conductivity of gases increases with temperature and in general decreases as the molecular weight is increased. The conductivity of gases is independent of pressure from one atmosphere down to moderately low pressures. Convection in insulating materials is a complex process and depends upon the prevailing temperature, pressure and kind of ambient[□] gas, and the density, dimensions, and orientation of the insulation specimen. The experimental method used in this investigation does not directly differentiate between gas conduction and convection, and the term *gas transferred heat* will be used to designate the total heat transferred by the gas within the insulating material.

Heat transferred by radiation through the gas spaces of insulating materials is independent of the ambient gas. When the percent volume occupied by the solid is small, heat transferred by radiation is approximately inversely proportional to insulation density and varies directly as the cube of the mean temperature. In some cases, the transparency of solid material to radiation is also a function of mean temperature.

The introduction of a solid material into a gas-filled space ordinarily reduces heat transfer by means of radiation and convection but increases gas transferred heat. This increase in gas transferred heat arises from the displacement of the gas with material of a higher conductivity and by an increase in the heat transfer area between the solid and ambient gas.

The heat transferred through the solid portion of the insulation depends upon the kind of material and the arrangement and size of the fibers or particles. Division of a solid material into a finely divided state can reduce the conductivity to a value lower than that of still air, by reducing the heat path[‡] below the mean free path of the gas molecules. For large volume ratios of gas to solid material, solid conduction is approximately proportional to density.

Recent papers[1,2] have shown that the major mode of heat transfer through most insulating materials is by gas transferred heat. Laboratory determination of this quantity is arrived at by difference, subtracting the conductivity obtained with gas extracted from that obtained with gas present. This research paper describes the investigation of the reduction in thermal conductivity of some common insulating materials by replacing the ambient air with gases of larger molecular weight. Experimental data will be presented for several materials showing the relative importance of heat transferred by radiation and by conduction through the solid material.

[†] This paper covers a part of the results of a research program conducted by the Engineering Experiment Station and supported in part by the Graduate School, University of Minnesota.

[*] Part I of this paper appeared in ASHVE TRANSACTIONS, Vol. 58, 1952, p. 155.

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[□] Ambient gas is the gas occupying the volume not filled by the solid portion of the insulating material.

[‡] *Heat path* is defined as the mean distance across confining spaces in an insulating material.

[1] Exponent numerals refer to References.

Description of Apparatus

The apparatus used in this investigation is shown in Figs. 1 and 2. Fig. 1 shows the assembled apparatus with the insulated bell jar lowered over the conductivity apparatus in position for test. The mechanical fore pump and oil diffusion pump for evacuating the vacuum chamber to an ultimate vacuum of 0.1 micron of mercury are shown underneath the table. At the left next to the wall is a vacuum gage and the constant-temperature alcohol bath, which supplies the cold plates with alcohol at any temperature between 100 F and −75 F. A five-ton monochlorodifluoromethane (F-22) condensing unit, not shown, provides the necessary refrigerating capacity.

Fig. 2 is a diagrammatic sketch of the pertinent details of the apparatus. A neoprene gasket is used to seal the bell jar to the base plate. All thermocouple leads, electric power leads, liquid lines for the cold plates, gage connections and vacuum pump connections are brought through vacuum-tight seals in the base plate.

The 12-in. suspended guarded hot plate contained within the bell jar was built on the same principle as previously developed at this laboratory with some refinements to adapt it to the special program. The actual test area is 8 in. square with a 2-in. guard ring.

Auxiliary equipment consists of dc power supply, switchboard, precision potentiometer, and sensitive temperature controllers.

Procedure

In making thermal conductivity determinations on materials at atmospheric pressure with gases other than air, the pressure in the vacuum chamber is reduced to the limiting pressure of the fore pump (about 5 microns of mercury) and the chamber is then filled with the gas under study. Mixtures of gases are obtained by filling the vacuum chamber to the partial pressure required to give the desired proportions by volume.

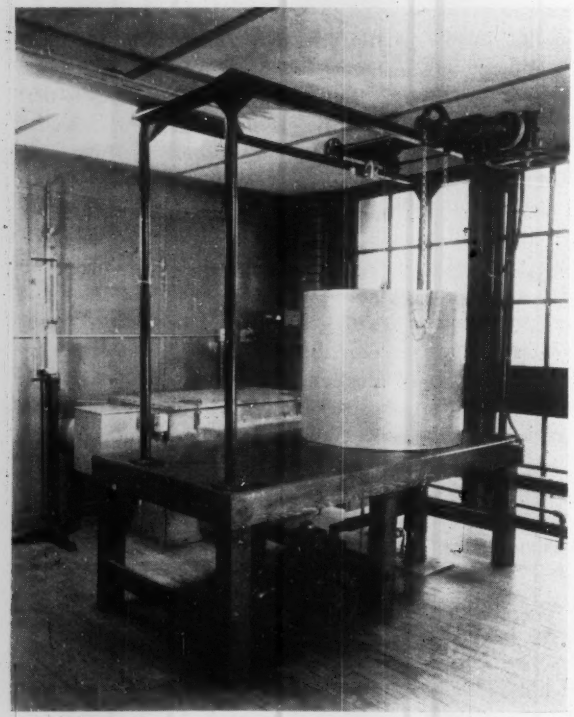
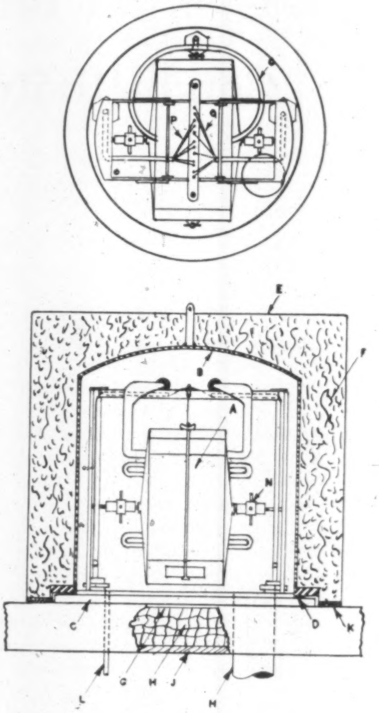


Fig. 1—Apparatus assembled in position for test showing exterior of steel vacuum chamber A

All materials were tested at the highest obtainable vacuum (about 0.1 micron of mercury absolute pressure) in order to reduce gas transferred heat to a minimum. All tests were conducted with a 50 deg temperature difference across the test specimen and at a mean temperature of 100 F, except as noted.



A — Suspended thermal conductivity apparatus
B — Steel bell jar
C — Bell jar base plate
D — Neoprene vacuum seal
E — Sheet metal container
F — Fill insulation
G — ⅛-in. pressed fiberboard
H — Corkboard
J — ¾-in. plywood
K — ½-in. sponge rubber
L — Vacuum gage connection
M — Diffusion pump connection
N — Clamping screws
O — Liquid lines to cold plate
P — Thermocouple connections
Q — Electric power connections

Fig. 2—Diagrammatic sketch of vacuum chamber and guarded hot plate apparatus

Materials Tested

Because of the large amount of time required to make precise thermal conductivity measurements, initial tests were limited to a relatively few materials whose characteristics were representative of the major classes of insulating materials. The materials selected for test were corkboard, cotton, glass wool, hair felt, kapok, mineral wool, silica aerogel, wood fiber, and wood fiberboard. In addition to these, a special test specimen was constructed by using eight sheets of aluminum foil between nine sheets of corrugated paper, the corrugations of alternate layers being at right angles to each other. Air spaces varying in width from ¼ in. to 1 in. and bounded by the copper plates of the test apparatus were also tested.

Corkboard and wood fiberboard were oven dried before testing. In the test, they were clamped between the plates and the thickness of the specimen was measured as set up for test. All loose and flexible materials were tested on an *as received* basis, the proper thicknesses being maintained by wood frames around the specimen edges or by special space blocks placed in the corners of the test specimen. In order to get a good test sample, the kapok and loose wood fiber materials were repacked. The other samples were tested without repacking.

Test Results

Table 1 lists thermal conductivity values obtained for the insulating materials selected for test, using three different ambient gases. The reduction in thermal conductivity using carbon dioxide instead of air ranges from 18 to 31 percent and by using dichlorodifluoromethane (F-12) from 28 to 56 percent.

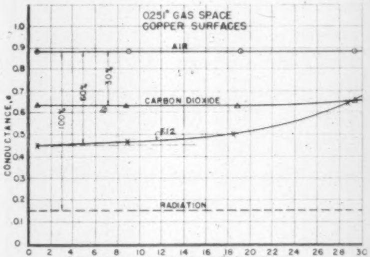


Fig. 3—Thermal conductance of ¼-in. gas space as a function of various ambient gases and partial atmospheric pressures

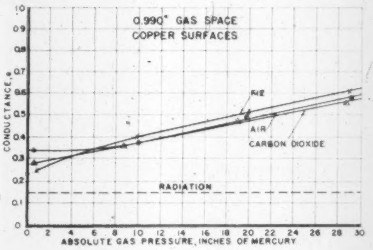


Fig. 4—Thermal conductance of 1-in. gas space as a function of various ambient gases and partial atmospheric pressures

Consideration of the gas transferred heat alone, as removed from that transferred by radiation and solid conduction, gives a better understanding of the ambient gas effect. The percent reduction in gas transferred heat using carbon dioxide instead of air is from 26 to 34 percent and for F-12 is from 33 to 60 percent.

Air transferred heat for the three fibrous materials, cotton, glass wool "A", and kapok, is greatest for the low insulation densities, declines to a minimum for the medium insulation densities and then increases again as density is raised to a high level. The high rate of air transferred heat for the low densities may be attributed to convection. Since the conductivity of all three materials with the air removed continued to decrease with increasing density, the increasing rate of air trans-

Table 1—Reduction in Heat Transfer Coefficients of Various Materials by Replacing the Air with Gases of Higher Molecular Weight
(100 F Mean Temperature and 50 Deg Temperature Difference)

Material	Density, lb/cu ft.	Thickness, in.	Thermal Conductivity, *k*				Air Transferred Heat, Btu (in.) (hr) (sq ft) (F deg)	Percent Reduction			
								Total Heat		Gas Trans Heat	
			Air	CO_2	F-12	Low Press,		CO_2	F-12	CO_2	F-12
Corkboard	6.67	1	0.283	0.222	0.195	0.106	0.177	21.6	31.1	34.5	49.7
Corkboard	12.4	1	0.314	0.256	0.218	0.120	0.194	18.5	30.6	29.9	49.5
Cotton	0.78	1	0.288		0.164	0.072	0.216		43.1		57.4
Cotton	1.53	1	0.257	0.192	0.1365	0.052	0.205	25.3	46.9	31.7	58.8
Cotton	2.62	1	0.248	0.180	0.120	0.033	0.215	27.4	51.0	31.6	59.5
Coarse Glass Wool	2.8	1	0.267	0.197	0.141	0.055	0.212	26.2	47.2	33.0	59.4
Fine Glass Wool "A"	0.58	1	0.2505	0.183	0.133	0.050	0.2005	26.9	46.9	33.7	58.6
Fine Glass Wool "A"	1.94	1	0.2145	0.148	0.097	0.0195	0.195	31.0	54.8	34.1	60.2
Fine Glass Wool "A"	3.80	1	0.211	0.146	0.093	0.012	0.199	30.8	55.9	32.7	59.3
Fine Glass Wool "B"	0.78	1	0.302	0.230	0.1715	0.0665	0.2355	23.8	43.2	30.6	55.4
Hair Felt	11.1	¾	0.260	0.185	0.124	0.031	0.229	28.8	52.3	32.8	59.4
Kapok	0.26	1	0.366	0.294	0.233	0.091	0.275	19.7	36.3	26.2	48.4
Kapok	0.99	1	0.2445	0.1765	0.1235	0.0375	0.207	27.8	49.5	32.9	58.5
Kapok	3.96	1	0.244	0.169	0.115	0.0175	0.2265	30.7	52.9	33.1	57.0
Mineral Wool	7.7	1	0.258	0.184	0.126	0.037	0.221	28.7	51.2	33.5	59.7
Silica Aerogel	8.6	1	0.1715		0.1235	0.0255	0.146		28.0		32.9
Special Specimen	3.1	1	0.231	0.1635	0.1125	0.0145	0.2165	29.2	51.3	31.2	54.7
Wood Fiberboard	15.5	¾	0.353	0.273	0.210	0.075	0.278	22.7	40.5	28.8	51.4
Wood Fiber	3.5	1	0.2715		0.1425	0.052	0.2195		47.5		58.8
Wood Fiber	6.9	1	0.277	0.202	0.142	0.033	0.244	27.1	48.7	30.7	55.3

Table 2—Effect of Reducing the Gas Pressure on the Thermal Conductance of Copper Bounded Spaces Filled with Various Gases
(100 F Mean Temperature and 50 Deg Temperature Difference)

0.251-In. Gas Space						0.990-In. Gas Space					
Air		Carbon Dioxide		F-12		Air		Carbon Dioxide		F-12	
P	*a*	*P*	*a*	*P*	*a*	*P*	*a*	*P*	*a*	*P*	*a*
29.3	0.882	29.5	0.652	28.8	0.643	29.3	0.581	28.7	0.552	28.9	0.604
19.3	0.883	18.7	0.635	18.5	0.500	19.8	0.490	18.9	0.472	20.0	0.514
8.9	0.882	8.6	0.634	3.8	0.458	10.0	0.375	8.7	0.355	9.8	0.399
0.5	0.891	0.55	0.634	0.5	0.445	0.5	0.333	0.5	0.277	1.0	0.247

P = Pressure, inches mercury. *a* = Conductance, Btu per (square foot) (hour) (Fahrenheit degree).

ferred heat for the high density materials must be due to *bypassing* of heat by increasing the transfer area between solid and ambient gas.

Low density corkboard exhibited next to the lowest rate of air transferred heat but had the highest rate of solid conduction. This explains the reported low conductivity value of expanded corkboard. The very low rate of gas transferred heat shown by silica aerogel, the single material having a rate less than that of low density corkboard, may be attributed to its finely divided state.

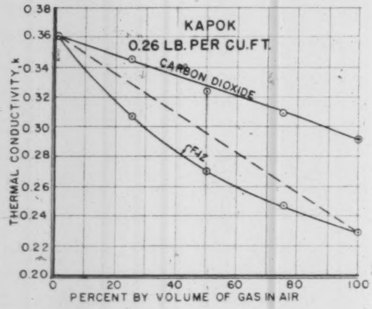


Fig. 5—Effect of various proportions of carbon dioxide and F-12 in air on the thermal conductivity of low density kapok

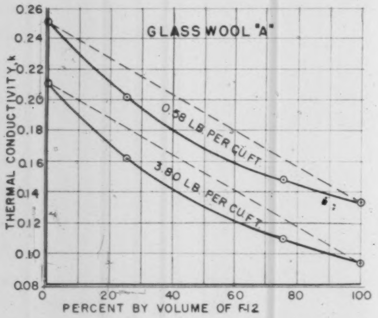


Fig. 6—Effect of various proportions of F-12 in air on the thermal conductivity of two densities of glass wool

Thermal conductivity values for ¼ in. and 1 in. wide gas spaces filled with air, carbon dioxide, and F-12 at various pressures are listed in Table 2, and illustrated in Figs. 3 and 4. Kinetic theory predicts that the conductance of these gas spaces should be independent of gas pressure, providing heat transfer by convection is negligible. Deviation from this prediction for the 1-in. gas space shows that convection is an important mode of heat transfer for all three gases over the entire pressure range. The results for the ¼-in. gas space show that convection is negligible throughout the range of test pressures when the space is filled with air. With carbon dioxide, convection subsides at a very moderate reduction in pressure, while with F-12, a large reduction in pressure occurs before convection subsides.

The conductances of the ¼-in. gas spaces as derived from Fig. 3 for a condition of no heat transfer by free convection are 0.882, 0.634 and 0.445 for air, carbon dioxide, and F-12 respectively. The gas conducted heat quantities for the three gases are 0.732, 0.484, and 0.295 respectively as determined by subtracting the heat transferred by radiation (0.150) from the previous values. Thus, the reduction in gas transferred heat obtained by substitution of carbon dioxide for air is 34 percent, and by substitution of F-12 for air is 60 percent. These percentages are identical to the maximum reduction in gas transferred heat for the insulating materials as given in Table 1, and indicate that heat transfer by convection in these materials is a small factor, except for low density kapok.

Table 3—Reduction in Thermal Conductivity of Several Materials by Partially Replacing the Air With Gases of Higher Molecular Weight

(100 F Mean Temperaure)

Percent of Gas in Air	Thermal Conductivity, *k*			
	Kapok, 0.26 lb/cu ft		Glass Wool "A" in F-12	
	Carbon Dioxide	F-12	0.58 lb/cu ft	3.8 lb/cu ft
0	0.361	0.361	0.250	0.211
25	0.346	0.307	0.202	0.162
50	0.324	0.270	0.170	0.131
75	0.309	0.247	0.148	0.109
100	0.292	0.228	0.133	0.093

Results of tests to determine the effect of various mixtures of gas in air on the thermal conductivity of kapok and fine glass wool are listed in Table 3, and illustrated in Figs. 5 and 6. The conductivity of kapok varies linearly with the percent of carbon dioxide present in the air mixture. Results obtained for mixtures of F-12 and air show that F-12 is the predominating gas and gives a greater percentage reduction in conductivity than represented by the percent of F-12 present.

Results of tests to determine the effect of mean temperature on the conductivity of glass wool "A" and fiberboard are listed in Table 4, and illustrated in Figs. 7 and 8. Table 4 shows that the percent of gas transferred heat increases as the mean temperature is reduced.

Figs. 9 and 10 show that the calculated gas transferred heat for glass wool and fiberboard is a linear function of mean temperature. In making these calculations for glass wool, the gas transferred heat was corrected for the volume occupied by the fibers, which amounts to about 2.5 percent for the highest density glass wool. The generally accepted value for the conductivity of still air is plotted for reference and is about 3 percent lower than the corresponding value of glass wool in air, thus indicating that convection is negligible.

The curves of Fig. 7 show that the conductivity of glass wool is decreased by increasing its density and that the amount of decrease is nearly independent of the ambient gas. The lower group of curves, developed under a test condition of very low pressure, gives the resulting heat transfer due to radiation and fiber conduction, since gas transferred heat is practically eliminated at these low pressures.

In Figs. 11 and 12, radiation has been separated from fiber conduction for the fibrous materials, cotton, glass wool "A", kapok, and wood wool, by considering radiation approximately inversely proportional to density and fiber conduction directly proportional to density. These figures show that for practical insulation densities, radiation is an important mode of heat transfer

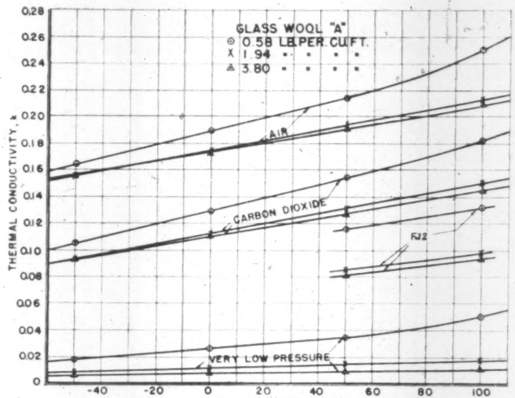
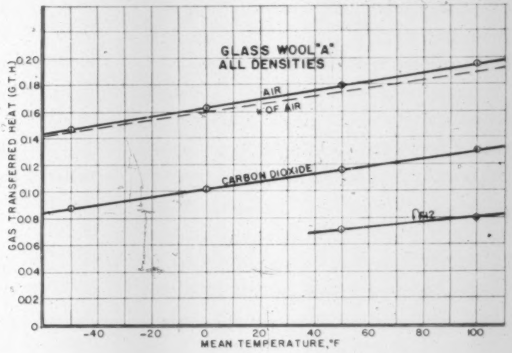


Fig. 7—Thermal conductivity of glass wool as a function of mean temperature, ambient gas, and density

Fig. 9—Gas transferred heat of glass wool for various ambient gases and mean temperatures



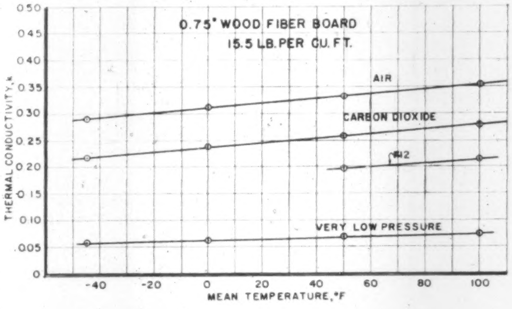


Fig. 8—Thermal conductivity of wood fiberboard as a function of mean temperature and ambient gas

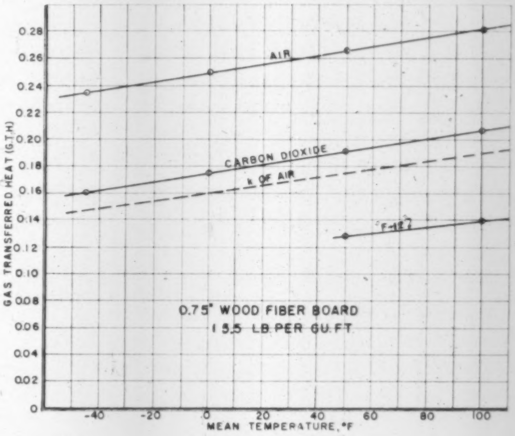


Fig. 10—Gas transferred heat of wood fiberboard for various ambient gases and mean temperatures

for all four materials, whereas heat transfer by fiber conduction is negligible.

Calculated values of heat transfer for glass wool with various ambient gases are given in Table 5. Fiber conduction is negligible for all test conditions. Heat transfer by radiation can be an important percentage of the total heat transfer, depending upon insulation density, ambient gas, and mean temperature. Decreasing the mean temperature increases the percent of gas transferred heat because radiation varies as the cube

Table 4—Effect of Mean Temperature on the Thermal Conductivity of Glass Wool and Fiberboard with Various Ambient Gases

Material	Mean temp, F	Thermal Conductivity, k				Gas Transferred Heat (G.T.H.)					
		Air	Carbon Dioxide	Freon, F-12	Low Press.	Air G.T.H.	CO_2 G.T.H.	CO_2, % decrease	F-12 G.T.H.	F-12, % decrease
1-in. Fine Glass	100	0.2505	0.183	0.133	0.049	0.2015	0.134	33.5	0.084	58.3
Wool "A",	50	0.2155	0.154	0.107	0.0355	0.180	0.1185	34.2	0.0715	60.3
0.58 lb per	0	0.190	0.1285		0.0255	0.1645	0.103	37.4		
cu ft	−50	0.1645	0.107		0.018	0.1465	0.089	39.2		
1-in. Fine Glass	100	0.214	0.150	0.0985	0.019	0.195	0.131	32.8	0.0795	59.2
Wool "A",	50	0.194	0.130	0.085	0.014	0.180	0.116	35.6	0.071	60.6
1.94 lb per	0	0.174	0.1125		0.0105	0.1635	0.102	37.6		
cu ft	−50	0.156	0.095		0.0075	0.1485	0.0875	41.1		
1-in. Fine Glass	100	0.211	0.1455	0.095	0.012	0.199	0.1335	32.9	0.083	58.3
Wool "A",	50	0.192	0.1275	0.082	0.008	0.184	0.1195	35.1	0.074	59.8
3.8 lb per	0	0.175	0.1105		0.0065	0.1685	0.104	38.3		
cu ft	−50	0.157	0.0955		0.0045	0.1525	0.091	40.3		
1-in. Fine Glass	100					0.1955	0.131	33.0	0.081	58.6
Wool "A", Average	50					0.179	0.1165	34.9	0.0715	60.1
of all densities	0					0.163	0.1015	37.7		
corrected for fiber	−50					0.147	0.088	40.1		
volume										
¾-in. wood fiber-	100	0.354	0.279	0.212	0.073	0.281	0.206	26.7	0.139	50.5
board,	50	0.334	0.259	0.196	0.068	0.266	0.191	28.2	0.128	51.9
15.5 lb per	0	0.312	0.237		0.062	0.250	0.175	30.0		
cu ft	−45	0.293	0.218		0.058	0.235	0.160	31.9		

of the mean temperature, whereas gas transferred heat varies linearly with mean temperature.

Since the relationship between conductivity and mean temperature for fiberboard is linear, heat transferred by radiation for this type of material is small. A comparison of the air transferred heat values for fiberboard and glass wool listed in Table 4 shows that air transferred heat is much greater for the fiberboard. This again is attributed to the increased heat transfer area between the solid and ambient gas.

Since gas transferred heat is the major mode of heat transfer in insulating materials at moderate mean temperatures, the reduction of this factor presents the greatest possibility for reducing the thermal conductivity of materials. For special applications, gas transferred heat may be reduced by using gases of low conductivity or by evacuating the gas from the material.

Table 5—Calculated Modes of Heat Transfer for Three Densities of Glass Wool "A" with Various Ambient Gases

Ambient Gas	Mean Temp.	Percent Heat Transferred								
		0.58 lb/cu ft			1.94 lb/cu ft			3.80 lb/cu ft		
		G.T.H.[a]	Rad	Fiber	G.T.H.[a]	Rad	Fiber	G.T.H.[a]	Rad	Fiber
Air	100	80.4	19.3	0.3	91.1	8.2	0.7	94.3	4.1	1.6
	50	83.5	16.3	0.2	92.8	6.4	0.8	95.8	2.9	1.3
	0	86.6	13.2	0.2	94.0	5.1	0.9	96.3	2.3	1.4
	−50	89.1	10.7	0.2	95.2	4.2	0.6	97.1	1.6	1.3
Carbon Dioxide	100	73.2	26.4	0.4	87.3	11.7	1.0	91.8	5.8	2.4
	50	76.9	22.8	0.3	89.2	9.6	1.2	93.7	4.3	2.0
	0	80.2	19.5	0.3	90.7	8.0	1.3	94.1	3.6	2.3
	−50	83.2	16.5	0.3	92.1	6.8	1.1	95.3	2.1	2.6
F-12	100	63.2	36.3	0.5	80.7	17.8	1.5	87.4	9.0	3.6
	50	66.8	32.8	0.4	83.5	14.7	1.8	90.3	6.7	3.0

[a] Gas Transferred Heat.

The principle of reducing gas transferred heat by making the length of heat path of the same order of magnitude or smaller than the mean free path of the gas molecules has been demonstrated by a number of investigators. A typical powder utilizing this principle and having a conductivity lower than that of still air at 100 F mean temperature and atmospheric pressure is silica aerogel. In order for present day fibrous materials to utilize this principle, the voids must be greatly reduced in size by decreasing the fiber diameter and perhaps by increasing the insulation density.

For all but one of the materials tested, convection contributed very little to the total heat transferred. This indication of the relatively insignificant effect of convection cannot be accepted for direct application to the practical case, since the isothermal surface temperature of the test specimen and its small size tended to minimize heat transfer by convection. However, it is safe to assume that the effect of convection will not reach important proportions except in the case of large volumes of low density materials.

Considerable heat may be transferred by radiation in low density fibrous materials at 100 F mean temperature. The percent heat transferred by radiation increases rapidly with mean temperature and conversely may become negligible at low mean temperatures. Radiation may be reduced by increasing the insulation density, opacifying the fibers, or coating the fibers with a reflective material.

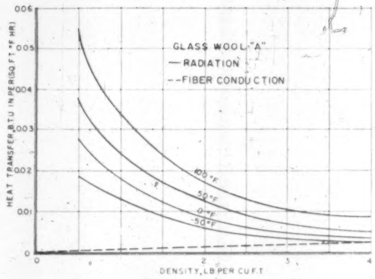


Fig. 11—Effect of density on the heat transferred by radiation and fiber conduction through glass wool at various mean temperatures

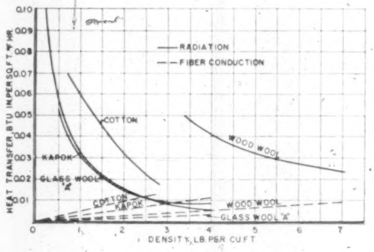


Fig. 12—Effect of density on the heat transferred by radiation and fiber conduction through various fibrous materials

For common fibrous insulation densities, conduction of heat along the fibers or by fiber contact contributed less than 2 percent to the total heat transferred through the materials tested. The practicability of increasing the insulation density for the purpose of reducing radiation or length of heat path is limited by the increase in fiber conduction and gas transferred heat.

Originally it was intended that this investigation into the modes of heat transfer be continued to cover a greater number of insulating materials over a much larger range of mean temperatures and with greater concentration placed on heat transfer by means of convection and radiation. This program has been interrupted by the total loss of equipment in the destruction by fire of the Oak Street Laboratory of the University of Minnesota in early 1953.

Acknowledgment

The author wishes to express his appreciation to Professor Emeritus F. B. Rowley for many helpful suggestions made during the course of this investigation, and to the Graduate School of the University of Minnesota for its financial assistance.

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Evaluation of Panel-Type Air Cleaners By Means of Atmospheric Dust

By H. A. Endres*, W. T. Van Orman** and R. P. Carter, Jr.†, Akron, Ohio

THE PROBLEM of atmospheric air cleaning is largely one of removing finely divided and highly dispersed carbonaceous matter, commonly known as soot or smoke. It is the finely divided carbon present in a normal industrial or city atmosphere that is responsible for most of the soiling of walls and furnishings in buildings. These highly dispersed and electrically charged carbon particles become deposited on such surfaces by thermal or electrical precipitation, or by sedimentation after flocculation, causing a substantial economic loss in cleaning, redecorating expense and soiled merchandise. In this respect smoke and soot should be classified with moths and corrosion as a public enemy. The term *spring cleaning* is a common household expression well known to every property owner and tenant, which usually signifies turmoil (dictionary definition: exhausting or distressing labor, disturbance, or confusion) and is never contemplated with joy. This can be avoided, or at least substantially reduced, by efficient air cleaning.

SUMMARY — The various types of synthetic dusts that have been used or advocated for evaluating the efficiency of panel-type air cleaners are unsuitable because they are not representative of the type of dust found in a normal city atmosphere. Filter tests can best be conducted by means of atmospheric dust and should be based on the reduction in soiling or smudging capacity resulting from the air cleaning operation.

As most of the air is recirculated in air heating and conditioning systems, the panel-type air cleaners employed should be evaluated under these conditions. When evaluated by means of recirculated atmospheric dust, self-charging electrostatic air cleaners give relatively high efficiency ratings.

The carbonaceous smoke particles present in a normal industrial or city atmosphere, like smokes in general, are characterized by particle sizes below 0.5 μ (microns). A study of atmospheric dust concentration in 14 American cities made by the U.S. Public Health Service in 1936 showed that the average amount of suspended matter in the air during the winter months was 0.51 milligrams per cubic meter, or 815 particles per cubic centimeter, of which 65 percent by weight consisted of carbonaceous matter and 35 percent of ash. This ratio of carbonaceous matter to ash of nearly 2:1 becomes nearly 3:1 on a volume basis, so that the ash is really of minor interest to air conditioning engineers. In spite of this fact, there has been a decided tendency to under-estimate the importance of the small particle size and highly dispersed carbonaceous matter.

According to the study made by the U.S. Public Health Service, the median size of the dust particles present in the normal city atmosphere during the winter months is 0.58 μ in diameter. The variation in particle size from city to city was found to be very small. Manufacturers of carbon blacks, who make smoke by the carload, usually refer to the surface area of their products in terms of acres per pound. Thus, carbon particles of the median size normally present in a city atmosphere would have a surface area of somewhat more than 0.5 acres per pound, which represents a high degree of soiling power.

According to Drinker and Hatch[1], clean country air contains as little as 0.1 to 0.2 milligrams of dust per cubic meter, but the atmosphere in manufacturing towns may contain as much as 2.0 milligrams or more. The latter figure is considerably higher than the average given by the U.S. Public Health Service. Drinker and Hatch state that the air within a modern air-conditioned building should not exceed 0.2 to 0.3 milligrams of dust per cubic meter, regardless of the concentration outside. However, these two authorities concerned themselves with the health and hygienic aspects of dust and not its smudging or soiling power. An atmosphere containing 0.2 milligrams of highly dispersed carbon smoke per cubic meter would give good cause for spring cleaning. In a system where the air is recirculated as many as 100 times per day it would have ample opportunity to do a thorough smudging job. Small carbon particles have very low settling rates, move with the smallest air currents, and in a sense are part of the air and go wherever it goes.

The authors of this paper believe that the dust used in evaluating air cleaning devices should be representative of the dust which is to be removed in service, and in most instances this is finely divided carbonaceous smoke of high blackening power. This concept led to the development of the weight-smoke test described in a previous paper.[2]

In a paper by R. S. Dill[3], in which a photometric method of testing air filters is described, it is stated that tests with atmospheric dust and smoke from a fuel oil flame were attempted but gave uniformly low efficiencies and were difficult to evaluate, but a variation of this method was found satisfactory for evaluating electrostatic dust precipitators. The present authors have pursued this test method further, and by making certain modifications and refinements, have arrived at a procedure that can be applied to the panel-type air cleaning devices.

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For presentation at the 61st Annual Meeting of THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, Philadelphia, Pa., January 1955.

[1] Exponent numerals refer to Bibliography.

Prepared Test Dusts

The authors wish to correct a commonly held misconception regarding prepared test dusts. The dusts most commonly used, or presently being advocated, for evaluating panel-type air filters are composed of relatively coarse siliceous particles up to $100\ \mu$ or more in diameter, and 25 percent by weight, or less, of carbon in the form of carbon black or lampblack. The intimation is that the carbon in this mixture is free and becomes dispersed when the dust is injected into the air stream during the test. The authors have found that it is not possible to disperse carbon black by itself into an air stream by any of the means thus far proposed[2]. When the finely divided carbon particles are associated with coarse particles, as in a test dust, they do not become disassociated when injected into an air stream.

In a test dust containing relatively large siliceous particles and fine carbon particles, the latter coat over and adhere to the surface of the former due to adhesion and adsorption. This can be shown by microscopical examination and by means of a simple demonstration. If equal volumes of two powdered materials of substantially equal particle size are intimately mixed, the color of the mixture will be influenced to the same degree by the components. That is, a mixture composed of black and white particles will be gray in color and the particles will maintain their distinctive characteristics. If, however, the black material is finely divided, like carbon black, and the white material is relatively coarse, like Arizona road dust, the particles of the latter become coated with the former and the mixture will be black.

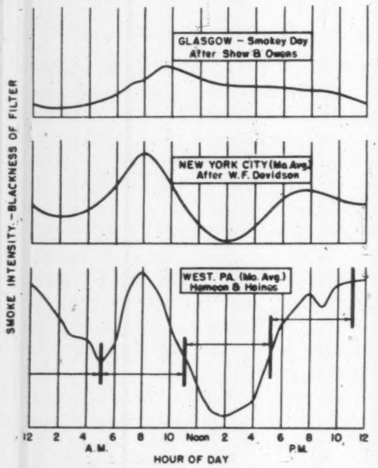


Fig. 1—Hourly variation of smoke intensity at Glasgow, New York and Western Pennsylvania

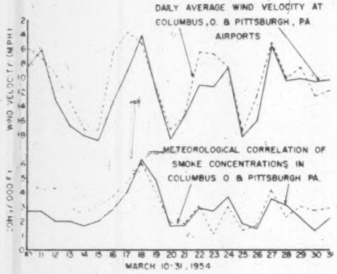


Fig. 2—Meteorological correlation of smoke concentrations

The carbon black particles are then no longer free and will be carried on the coarse particles in the dust stream and behave as an integral part of the coarse particles. Therefore, such test dusts are not suitable for determining the efficiency of atmospheric air filters as they do not even approximate atmospheric dust.

The authors have shown in a previous paper[2] that a highly dispersed and finely divided carbonaceous smoke can be generated and controlled by burning mixtures of alcohol and benzene. This smoke can be used to augment or reinforce atmospheric dust in evaluating filter performance when the dust content of the air is low. This will be discussed later in the present paper.

Hourly Variation in Atmospheric Smoke Content

Referring to the work of Hemeon[4], Fig. 1 shows the diurnal variations in smoke intensity in Glasgow, New York City, and Western Pennsylvania. It is significant in these three radically different locations that a maximum occurs between the hours of 8:00 a.m. and 10:00 a.m. In this hemisphere a minimum of intensity occurs at about 2:00 p.m. The meteorologist will recognize that the time of minimum dust content, 10 a.m. to 5 p.m., coincides with the period of maximum wind velocities. The maximum smoke content coincides with the sunrise calm integrated with the starting of industrial activity for the day.

Through Hemeon[5], the authors received curves showing the correlation between the smoke concentration in the air at Pittsburgh and Columbus on March 10 through March 31, 1954, as shown in the lower portion of Fig. 2. The Coh is a unit defined as the quantity of carbonaceous matter corresponding to an optical density of 0.01. Optical density is equal to Log_{10} (100/percent transmitted light). Hence, to express the number of Coh units, multiply the optical density by 100.

This excellent correlation shows that the maximum intensity of smoke in the air occurs at the same time in these two cities. At the 1954 *Air Pollution Control Association* meeting, where these curves were presented, they aroused much interest. This was the first time that such a correlation had been demonstrated. A study of these curves indicates that a cyclic control factor, probably of meteorological origin, has caused these remarkable phenomena.

By plotting the daily average wind velocities at the airports at Columbus and Pittsburgh on an inverted scale, in the upper portion of Fig. 2, it is seen that the maximum smoke intensity occurs at a minimum wind velocity. Likewise, a minimum smoke intensity occurs at a maximum wind

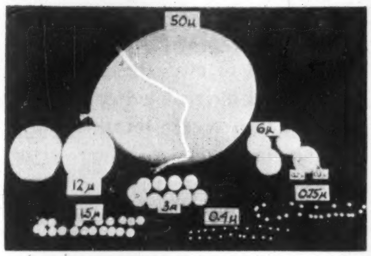


Fig. 3—Model of typical outdoor dust dramatizing extreme range of sizes

velocity. Hence the interpretation can be made that the smoke intensity of the air is inversely proportional to the wind velocity. This correlation between smoke content of the air and wind velocity should help clarify the authors' interpretation of the variables which are encountered in testing air cleaners with atmospheric dust.

Hubbard[7] has pointed out that the Coh is actually the number of square feet of dust deposit of optical density 1.0 per thousand cubic feet of air. An optical density of 1.0 means that the dust deposit will be 90 percent black. The authors believe that Hubbard's proposal of a standard of 25 percent reduction in transmitted light is to be preferred.

Importance of Particle Size

In his measurement of air pollution, Hemeon[4] pointed out that weight concentration measurements of dust in gaseous suspension give only the weight of the largest particles in a sample. This is true regardless of the absolute size of the largest particles. In outdoor measurements the weight concentration reflects only the air pollution nuisance commonly referred to as dust fall — the gravity deposition of solids on horizontal surfaces, which is primarily caused by large particles. If the pollution effect being explored is caused by small particles, weight measurements are worthless because the small particles contribute insignificantly to the total weight. This is illustrated in Fig. 3. Here it will be noted that if the one 50 μ particle size is captured, it will represent 97 percent of the total weight involved. It is comparatively easy to capture a 50 μ particle and more difficult to capture the smaller particles. The weight approach is not adequate, for it gives practically no credit for the capture of finely divided carbonaceous matter.

Other authorities estimate that particles 6 μ and under represent over 99 percent of the soiling power of atmospheric dust. Herein lies the most difficult problem of air cleaning. It may be easier to understand why the smaller size particles are so difficult to capture by referring to Fig. 4. Here, the particle size in microns is plotted against horizontal travel in feet. The distance travelled horizontally is that distance through which the particle will travel in falling a vertical distance of 1 ft. For example, a 100 μ particle will travel only 5 ft. A 10 μ particle will travel about 430 ft. It is particularly significant to note that a one micron particle will travel 8.12 mi. In other words, there is an extremely rapid increase in the flotation power of the particles between 10 μ and the lower limits, which makes these particles incapable of capture by centrifugal or inertial forces. Only electrical forces operate effectively on them.

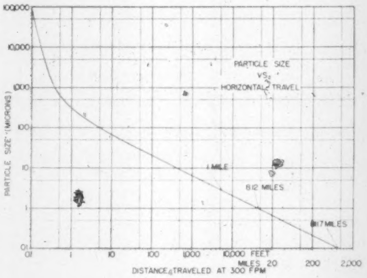


Fig. 4—Flotation curve of various size particles

Note: From data on Page 153, Heating, Ventilating, Air Conditioning Guide 1953, Size and Characteristics of Air Borne Particulate Matter. All particles assumed spherical with density of 1.00 and constant horizontal velocity of 300 fpm. All distances represent horizontal travel during a fall of one foot.

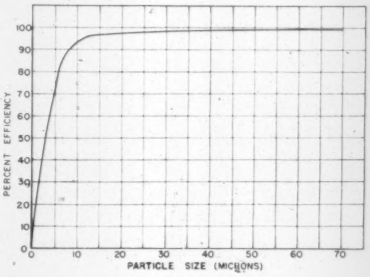


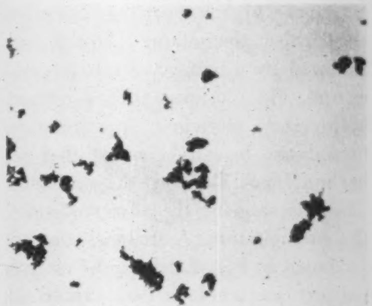
Fig. 5—Engine air cleaner efficiency *vs.* particle size of the dust[6]

Efficiency *vs.* Particle Size

Begley[6] presented the curve shown in Fig. 5, which represents engine air cleaner efficiency plotted against particle size. This curve is similar to one published by a manufacturer of adhesive coated impingement filters, which shows efficiency based on various particle sizes. The significant point shown by these curves is that below 10 μ the efficiency of the filters falls off rapidly. This is characteristic of most impingement filters and clearly defines the area where greater effort in cleaning air should be directed.

Fig. 6 shows the agglomerated carbonaceous material accumulated 30 ft down-stream from a self-charging electrostatic air cleaner. These agglomerated particles range from 150 μ to 250 μ in size, whereas the initial carbonaceous matter in the air was of the order of one micron and less. The authors reason that if it is possible to cause agglomeration by such a simple mechanism, then by recirculating the air it should be possible to greatly increase the efficiency of the electrostatic air cleaners. Therefore, they initiated a program of evaluating panel-type air cleaners by means of recirculating atmos-

Fig. 6—Agglomeration of carbonaceous matter by passage through an electrostatic air cleaner, magnification 50X



pheric dust, since most of the air is recirculated during the normal operation of heating and air conditioning systems.

The principles involved in the agglomeration of small particles have been demonstrated in the production of the furnace carbon blacks widely used in the rubber industry. The average particle diameter of such carbon blacks ranges from 0.01 to 0.5 μ. These compare closely in size with the carbonaceous matter found in the air. As Keevil[8] states, *Most of the airborne matter is in the size range of* 0.2 *to* 1 μ, *a micron being* 0.001 *of a millimeter or* 0.00004 *in.* Most furnace blacks[9] are made by a continuous process involving the partial combustion of natural gas or other hydrocarbons in specially designed furnaces and resulting in the formation of carbon black and gaseous products. After being cooled with sprays of water, the carbon black is separated from the gaseous stream by means of extremely high voltage in extensive electrical precipitator equipment, followed by a battery of tubular collectors. Fig. 7 shows such a system with the electrical precipitators turned on. It will be noted that no carbon black escaped, only a cloud of steam showing the effectiveness of the precipitation. A striking contrast is shown in Fig. 8, where the electrical precipitators have been turned off and clouds of carbon black escaped into the air. Thus, the principle of agglomeration is utilized in the collection of this fine, hard to catch carbonaceous matter. Of the carbon black used in 1952, 1 1/3 billion lb were collected by means of this mechanism.

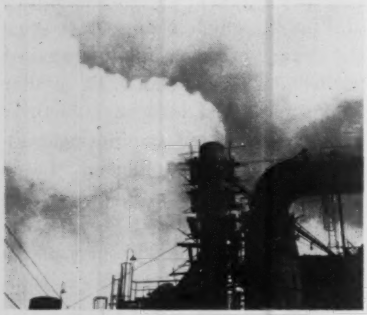


Fig. 7—Showing the efficiency of a carbon black plant with electrical precipitator agglomerating carbon black particles

In a previous paper on self-charging electrostatic air filters[2] the present authors showed that when two electrostatic filters are used in series the downstream unit may collect more dust than the upstream. At that time the authors were unable to explain this phenomenon, but since then it has occurred many times and there has been an opportunity to observe it more closely. Apparently, a particle which has escaped capture by an electrostatic filter acquires an electrostatic charge which causes it to agglomerate with other particles downstream. These agglomerated and charged particles are more easily captured than the original particles. Hence, a downstream electrostatic filter often picks up more dust than the upstream filter.

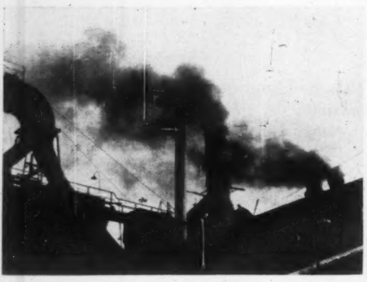


Fig. 8—Plant in Fig. 7 with electrical precipitator turned off

Evaluation of Panel-Type Air Cleaners with Recirculated Atmospheric Dust

In the past it has been the practice to carry out evaluation tests of panel-type air cleaners on a single pass basis. By this procedure the air containing dust is passed through the air cleaner only once and then exhausted. As pointed out previously, this is not in accordance with normal air heating or cooling procedure where a major portion of the air is recirculated repeatedly. It is, therefore, logical to evaluate air cleaners by means of recirculated atmospheric dust and thus obtain information regarding performance under actual service conditions. In an effort to accomplish this objective the following procedure was developed.

In order to run a continuous series of tests over a prolonged period without an operator present at all times, a heavy duty automatic dust sampler and recorder with special attachments was employed. This machine is shown in Fig. 9. A ribbon of Whatman No. 4 filter paper is passed through the mechanism and atmospheric air is drawn through the filter paper on a schedule of 25 min for a spot and then 5 min for moving the tape to the next spot. Automatic controls carry out this function so that continuous tests are conveniently made.

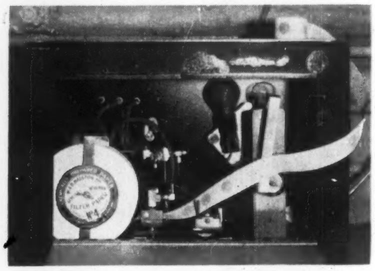


Fig. 9—Automatic dust sampler and recorder

Whatman No. 41 filter paper is frequently used for atmospheric dust tests. Smith and Suprenant[10] have shown that there is less variation in Whatman No. 4 filter paper than in conventional Whatman No. 41. Visual examination shows more frequent occurrence of fine pinholes in Whatman No. 41 than No. 4. The rate of flow of the sample of air drawn through the paper is carefully controlled by maintaining constant suction.

Recirculated air tests were conducted in a rectangular room having a volume of 2785 cu ft. The room has four windows and a door, all of which were sealed against air leakage with masking tape. A wind tunnel 16 ft long and 20 in. x 20 in. in cross section was used throughout the tests. In all the tests an air velocity of 300 fpm was maintained through the filter. Since this is equivalent to 833 cfm, the air in the room was passed through the filter every 3.34 min.

The tracing head inserts of the recorder were changed to produce a ½-in. diameter spot and the filter paper tape drive speed was changed to 12 in. per hr. The vacuum pump was adjusted so that the vacuum was 5 in. Hg throughout the tests. Under these conditions a constant amount of air was sampled from the tunnel at a rate of 43.6 cfh. This amounted to 18.2 cu ft for each 25 min spot test.

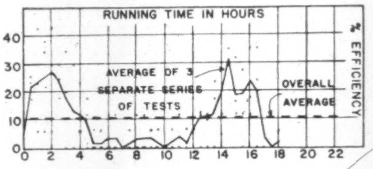


Fig. 10—Results of 107 atmospheric dust tests using recirculated air and 1 in. viscous impingement filter

A timer was used to supplement the recorder. The maximum setting of the timer was 120 min on and 120 min off; however, it was set so that air was sampled for 25 min and the filter paper tape was moved for 5 min — a total cycle of 30 min.

The air was sampled through ½-in. diameter copper tubing from the upstream side of the filter being tested. This was done so that the dust level of the room air would be recorded and no immediate advantage taken of freshly filtered air.

Evaluation of the dust spots was made by means of a 4½-in. 0-200 microammeter, a photocell unit, and a light source consisting of a 60-watt frosted glass bulb. The photocell unit consisted of a 3¼-in. diameter selenide coated photocell and a shield with a ½-in. diameter hole in the center. When evaluating the dust spots, the tape was moved so that the spot fitted exactly over the hole in the shield and a reading was taken on the microammeter. The reading in microamperes was then converted into filter efficiency using the method described in the Appendix.

In the initial test runs there was some air leakage into the room; however, this was later eliminated. The sampling pump for the recorder should not be located in the room where the tests are made, because the pump has an oil bath silencer and filter and oil droplets from the silencer may cause some discoloration of the filter paper.

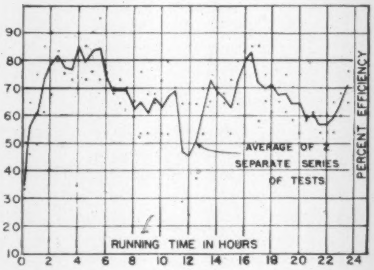


Fig. 11—Results of 95 atmospheric dust tests with recirculated air and ½ in. electrostatic panel type air cleaner

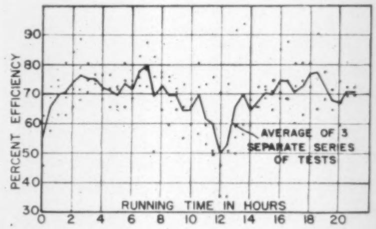


Fig. 12—Results of 122 atmospheric dust tests with recirculated air and 1 in. electrostatic panel type air cleaner

Evaluation of Viscous Impingement Filters

The performance of 1 in. viscous impingement filters, based on recirculated air tests, is shown in Fig. 10. The average efficiency by three separate series of tests, or 107 individual tests, is 11.05 percent. This figure agrees with the commonly accepted values obtained by present test code procedures and published by filter manufacturers. It should be pointed out that in this type of filter no agglomeration takes place; hence, little or no benefits are derived from recirculation.

Evaluation of Self-Charging Electrostatic Air Cleaners

Fig. 11 shows the results obtained with a ½ in. electrostatic air cleaner. Two separate series of tests (95 individual tests) gave an average value of 67.13 percent. This filter has a resistance of only 0.07 in. of water at 300 fpm air velocity.

In Fig. 12 an average efficiency of 70.08 percent is shown for 122 separate tests on a 1 in. self-charging electrostatic air cleaner.

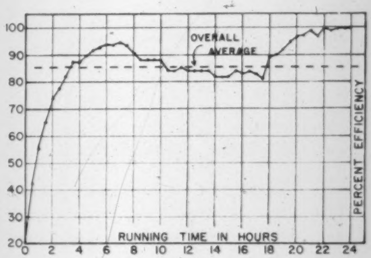


Fig. 13—Results of 48 tests with smoke-enriched atmospheric dust and recirculated air with 1 in. electrostatic panel type air cleaner

Testing With Smoke Enriched Atmospheric Dust

It has been shown that variations in the dust content of the atmosphere may make it difficult to test with this medium at all times. In order to meet situations like this it has been found practicable to enrich the air with carbonaceous particles one micron and less in diameter by burning a mixture of 65 percent alcohol and 35 percent benzene in a small laboratory lamp for a period and then proceeding with the tests. Fig. 13 presents the data obtained with a 1 in. self-charging electrostatic air cleaner using smoke enriched air, covering 48 separate tests. The average value is 85.05 percent. The high efficiency values may be due to the fact that the smoke concentration in the air was considerably greater than normal. Reducing the time of burning the lamp should make it possible to obtain a normal smoke concentration in a given test room and thus duplicate the results of atmospheric dust tests. However, other factors may be involved, such as the magnitude of the charge on the freshly generated smoke particles. In commenting on a previous paper[2], Nutting stated that *smoke generators produce highly charged aerosols, and charged aerosols are easier to collect than uncharged.* It has been our experience with self-charging electrostatic air cleaners, that the greater the dust content of the air, the higher the efficiency.

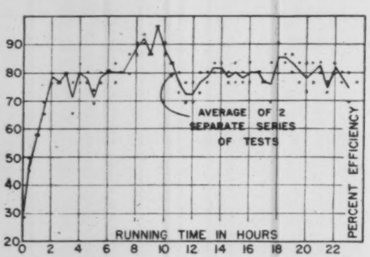


Fig. 14—Results of 93 tests with atmospheric dust and recirculated air passed through two 1 in. electrostatic panel type air cleaners spaced 1 in. apart

In Fig. 14, two 1 in. electrostatic air cleaners spaced 1 in. apart show an average efficiency of 77.79 percent in 93 tests. When several electrostatic air cleaners are employed in series, the benefits resulting from induced charges and agglomeration of the smaller particles by electrostatic attraction are clearly demonstrated.

In Fig. 15 is presented another concept of the effectiveness of two electrostatic air cleaners spaced 1 in. apart. Here the authors use the height of a column of air required to produce a 25 percent reduction in transmitted light through the filter paper as a criterion of efficiency. It will be noticed that at the beginning of the test the column of air was 8000 ft in height, the peak value was 250,000 ft, and the overall average was 42,000 ft. This is an excellent means of visualizing the dirt content of the air at any particular moment. The authors are greatly indebted to Hubbard[7] for the conception of this method of presentation and the mathematical calculations which follow.

$$I_t = \text{transmitted light, final.}$$
$$I_o = \text{incident light through clean paper.}$$
$$L = (V_s/A_s).$$

where

$$V_s = \text{cubic feet of air sample to obtain } (I_t/I_o) = 0.75.$$
$$A_s = \text{spot size (square feet)} = [\pi/(4 \times 144)] \times (1/2)^2 = 0.00136 \text{ sq ft.}$$
$$V'_s = (25/60) \times 43.6 = 18.2 \text{ cu ft}$$

when V'_s is cubic feet of actual air sample, and rate of flow is 43.6 cfh.

$$(V_s/V'_s) = [\log 0.75/\log (I_t/I_o)].$$

therefore

$$\begin{aligned} L &= [(V'_s/A_s) \times (V_s/V'_s)] \\ &= (18.2/0.00136) \times [\log 0.75/\log (I_t/I_o)] \\ &= (18.2/0.00136) \times [-0.1249/\log (I_t/I_o)] \\ &= (18.2/0.00136) \times [-0.1249/\log (I_o/I_t)] \\ L &= [1670/\log (I_o/I_t)] \end{aligned}$$

Another method of illustrating the effectiveness of air cleaning devices, which was also originated by Hubbard[7], is based on the decrease in the area of discoloration having 25 percent reduction in transmitted light. By this method it is possible to compute the cleaning benefits derived from the removal of soiling dust from the air. This is illustrated by Fig. 16. At the beginning of the test, the area of discoloration was 12 sq ft. This was reduced to a minimum of 0.4 sq ft during the test and an average value of 2 sq ft throughout the test.

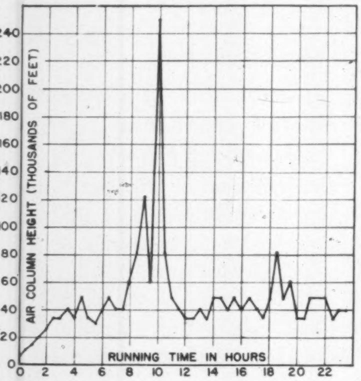


Fig. 15—Performance of electrostatic panel type air cleaners in terms of height of air column to produce 25 percent reduction in transmitted light. (results of 47 tests using atmospheric dust with recirculated air and two 1-in electrostatic panel type cleaners spaced 1 in. apart)

Conclusions

The problem of atmospheric air cleaning is largely one of removing finely divided and highly dispersed carbonaceous matter, commonly called soot or smoke. Therefore, air cleaning devices should be evaluated by means of atmospheric dust containing the normal concentration of soot or smoke.

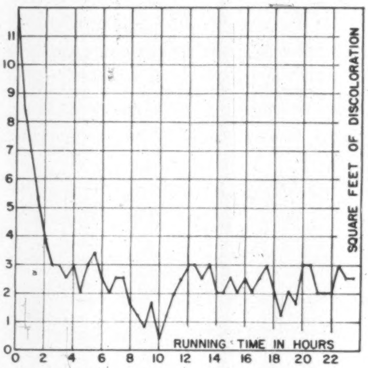


Fig. 16—Data from tests in Fig. 15 when expressed in terms of square feet of discoloration. (25 percent reduction in transmitted light)

Self-charging electrostatic air cleaners offer an effective and economical means of removing highly dispersed carbonaceous particles and other dusts normally present in the atmosphere, when used in conventional forced draft heating and air conditioning systems.

Passage of the highly dispersed dust and smoke particles through the electrostatic medium enhances the charge and causes agglomeration, thus increasing the air cleaning efficiency of a recirculating system.

Acknowledgements

Photos through courtesy of W.C.L. Hemeon (Fig. 3) and Columbian Carbon Co. (Figs. 7 and 8).

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APPENDIX

Evaluation of the Dust Spots

In order to evaluate the series of spots on the filter paper tape an equation has to be used which will allow the range of efficiencies to vary from 0 to 100 percent depending on darkness of the dust spot. Equations based on upstream and downstream spots are not applicable because the recorder registered only one spot for each test period. However, it is possible to derive an equation from the Lambert-Beer law of transmitted light which gave the desired data. This law can be stated mathematically as follows:

$$\log (I_o/I_T) = KCL$$

where

I_o = incident light.
I_T = transmitted light.
K = a constant depending upon the transmitting medium.
C = unknown concentration of sample.
L = depth of the medium.

A few assumptions must be made before this equation can be applied. First, it is assumed that the microampere output of the photocell is directly proportional to the light falling on the cell. It is also assumed that the reflectance and diffusion of the light through the filter paper are constant for all dust spots. This is not exactly true, but the differences are so small that they can be ignored. It is also assumed that the light transmittance through the clean filter paper is constant, which assumption was checked and found to be true.

Since every spot on the tape is compared with the zero spot, the latter should be described first. This spot will be designated S_1. Any other spot compared to the zero spot, S_1, can be called S_2. The zero spot (dust spot sampled from the unfiltered atmosphere) can be designated by the equation:

$$\log (I_o/I_1) = K_1C_1L_1$$

and the spot sampled from filtered air can be designated by the equation:

$$\log (I_o/I_2) = K_2C_2L_2$$

In these equations:

I_o = transmitted light through clean filter paper.
I_1 = transmitted light through dust spot from normal air.
I_2 = transmitted light through dust spot from filtered air.

C_1 = normal dust level.
C_2 = unknown dust level of filtered air.
K_1 = a constant depending on the transmission at spot S_1.
K_2 = a constant depending on the transmission at spot S_2.
L_1 = thickness of the filter paper at spot S_1.
L_2 = thickness of the filter paper at spot S_2.

Dividing the equation for S_1 by the equation for S_2,

$$[\log (I_o/I_1) \;/\; \log (I_o/I_2)] = [(K_1C_1L_1)/(K_2C_2L_2)] \quad \ldots\ldots\ldots (1)$$

Reducing Equation 1,

since

$$K_1 = K_2$$

and

$$L_1 = L_2$$

$$[\log (I_o/I_1) \;/\; \log (I_o/I_2)] = (C_1/C_2) \quad \ldots\ldots\ldots (2)$$

Now solving Equation 2 for C_2 (the dust level after filtration):

$$C_2 = C_1 \times [\log (I_o/I_2) \;/\; \log (I_o/I_1)] \quad \ldots\ldots\ldots (3)$$

Since C_1 is the normal dust level and C_2 is the dust level after filtration, the percent efficiency would be equal to:

$$[100\,(C_1 - C_2)]/C_1 \quad \ldots\ldots\ldots (4)$$

Substituting Equation 3 into Equation 4 and reducing, a usable equation is reached, viz.:

$$\text{Percent Efficiency} = \frac{100\left(C_1 - C_1\dfrac{\log I_o/I_2}{\log I_o/I_1}\right)}{C_1}$$

$$= 100\,\frac{C_1}{C_1}\left[1 - \frac{\log\dfrac{I_o}{I_2}}{\log\dfrac{I_o}{I_1}}\right]$$

$$= 100\left[1 - \frac{\log\dfrac{I_o}{I_2}}{\log\dfrac{I_o}{I_1}}\right] \quad \cdots\cdots (5)$$

The efficiency becomes zero when $I_2 = I_1$, which is the same as saying that the dust level of filtered air is the same as the dust level of the unfiltered air. The efficiency is equal to 100 percent when $I_2 = I_o$, or when the air contains no dust. These two conditions can be proved by simply substituting the values in Equation 5.

Equation 5 is actually the same as that of Hubbard[7], viz.,

$$\text{Percent Efficiency} = 100\left[1 - \frac{t_u \times Q_u \times \log\dfrac{\mu a^{*}\ \text{downstream start}}{\mu a\ \text{downstream finish}}}{t_D \times Q_D \times \log\dfrac{\mu a\ \text{upstream start}}{\mu a\ \text{upstream finish}}}\right]$$

Because each spot on the tape represents the same total flow of air, the $t_u \times Q_u$ term equals the $t_D \times Q_D$ term and therefore cancels out. The (μa downstream start) and (μa upstream start) terms apply to clean filter paper, which is I_o. The (μa downstream finish) and (μa upstream finish) are the same as I_2 and I_1, respectively.

The results obtained with the Dill dust spot tester, manufactured according to the National Bureau of Standards design, can also be related to this equation. Since the spots on the filter paper are balanced photometrically before, during, and after the test, the logarithmic terms cancel out leaving

$$\text{Percent Efficiency} = 100\ [1 - (t_u \times Q_u)/(t_D \times Q_D)]$$
$$= 100\ [(t_DQ_D - t_uQ_u)/(t_DQ_D)]$$

Usually the time of sampling upstream and downstream air is the same, and the equation reduces to:

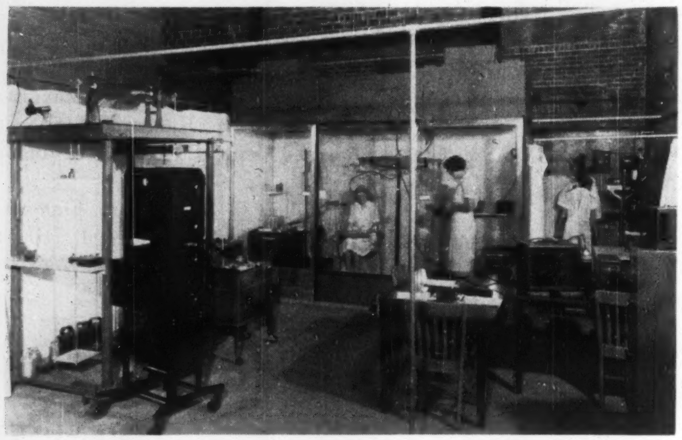
$$\text{Percent Efficiency} = 100\ [(Q_D - Q_u)/Q_D]$$

The Dill spot tester is useful in exploring single pass efficiencies of panel air cleaners.

$^{*}\mu a$ = microamperes.

Things We Need to Know About Air Conditioning and Environmental Physiological Research

By M. K. Fahnestock*, Urbana, Ill.



Environmental Physiological Research Laboratory
Psychological and physiological measurements can be made on people under different conditions of temperature, humidity and air motion, and work rates. Such laboratories are expensive to build, to equip, and to operate.

What affects human comfort, health, and efficiency more than the thermal environmental factors around which the heating, ventilating and air conditioning industry and profession are built? True there are many other factors, such as air cleanliness, air contamination, odors, noise, illumination and vibration within the scope of the profession, but by and large the thermal factors are major ones.

Heat and Its Control

In the process of living people generate heat. The quantity of heat produced depends upon age, sex, and degree of activity or rate of work. To be comfortable, healthy, and efficient, people must transfer this heat to their surroundings without incurring undue stress. Most members of ASHVE are in one way or another concerned with ways and means of regulating the transfer of this heat by controlling the ambient temperature, humidity, air motion, and radiation commonly encountered in occupied spaces. These are the thermal factors.

The Society's Responsibility

Obviously, it is the responsibility of the Society to know or to find out the optimum levels of these thermal factors which so greatly concern its members. Only comprehensive environmental physiological research, with objective and subjective measurements of the physiological and psychological effects induced by the environments encountered can give the answers.

Some Things the Society Has Done

The Society can be justly proud that about 30 years ago it pioneered work to establish the combined effect of temperature, humidity and air motion on the degree of warmness or coldness felt by individuals. This work resulted in the development of the Effective Temperature Index and the Comfort Chart for normal sedentary individuals, lightly clothed in still air. Later, this work was extended to include the relationship between the total heat loss at different work rates, effective temperatures, and the effects of air motion.

Following are examples of results of more recent laboratory studies and field experiences.

1. Healthy normal males and females make rapid physiologic adjustments without ill effects when going from hot-humid conditions (outdoors in summer) into comfortable conditions (air-conditioned spaces) or from comfortable conditions to hot-humid conditions. Persons with certain physiological impairments can readily make the same adjustments. The practical application of this knowledge is the abandonment of the idea that there should be a minimum difference between the indoor and outdoor conditions during the summer.

2. Adult males and females normally clothed and at rest or doing light work are comfortable the year 'round with temperatures of from 73-77 F and relative humidities at any level between 25 and 60 percent. Thus, the Comfort Chart over-emphasizes the effects of relative humidity in the zone of non-evaporative heat regulation.

3. Other results are concerned with the extremes of environments encountered in industry and the military services.

Some Things We Need To Know

The tremendous increase in the use of air conditioning has greatly emphasized the need for more objective basic information on the physiological effects in people induced by environments commonly encountered and by extremes in environments not uncommonly encountered in industry and in the military. One investigator, Professor Theodore F. Hatch, has roughly divided thermal environmental conditions into three general categories: (*a*) comfortable conditions, (*b*) those of acute physiological tolerance, and (*c*) those in the region between the upper limits of comfort and the lower limits of acute physiological tolerance. Additional data on physiologic indexes in all three regions are needed.

Environmental physiological research resulting in improved health, comfort and working efficiency offers ASHVE a most unusual opportunity to serve all its members and the public. Why should not the progressive heating, ventilating and air conditioning industry have the answers to such questions as:

1. Does comfort air conditioning serve to lessen the physiological stress on the general population, both normal and impaired persons, during continued hot weather, and, if so, why?
2. Does air conditioning increase the working efficiency or output of workers in different industries, and, if so, how much?
3. What is the optimum level of humidity for the home and office during the heating season from the standpoint of health?
4. What is the maximum air movement acceptable for different temperature, humidity and radiation levels at different rates of work?
5. How can the mean radiation temperature in a non-uniform environment such as a school room be conveniently measured and what is the combined effect of temperature, humidity, air motion and radiation on comfort?
6. What uses can be made of air conditioning in the treatment and care of the sick, including surgical and mental cases?
7. What are the physiological indexes and their limiting levels which can be used for satisfactorily evaluating industrial environments and work-conditions from the standpoint of acceptable physiological stresses induced by ambient thermal conditions and work rates?

Who Should Pay the Costs

The heating, ventilating, and air-conditioning industry should logically pay the cost of the research required to obtain information which *all of its members* and the public need.

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*Chairman ASHVE Technical Advisory Committee on Physiological Research.

SEASON'S GREETINGS TO OUR MEMBERS

DEAR MEMBERS:

We are approaching that heaven-blessed season whose magic mellows the minds of men. In a few days we shall experience again the miracle of Christmas, which happens every year — yet seems new each year. It gives us a spiritual uplift and we get an encouraging glimpse of the kind of world this was intended to be. No one who is exposed to the wonders of Christmas is immune to its blessed contagion.

The transcendent power of the Christmas spirit is evident everywhere — in our homes, in our offices and factories, on the streets and in public places. The engineering mind wonders if there is not some way to capture the tremendous moral power that is generated at this time of year and distribute it with such efficiency that it will provide the greatest benefit without wasting a single unit. Mankind has the ability to generate this power — more than enough for everyone — three hundred sixty-five days of the year. Probably we should pay more attention to the means of generation and distribution will take care of itself.

At Christmastime, it seems, we experience certain feelings more keenly and more sincerely than at any time during the year. These feelings are part of the spirit of Christmas. And while we are under its magic spell, we find time for reflection, meditation, courtesy, friendliness, and enjoyment.

This spirit of Christmas is the spirit of love. It causes us to rejoice with our loved ones and to miss more keenly those whom we love who cannot be with us. We feel a strong desire to make others happy and to share our own good fortune with those who are less fortunate.

This is a time for self-criticism and for self-appraisal — when we, as members of ASHVE, might well reflect on our own aims, activities, and accomplishments. Are we serving our purpose as an educational and scientific organization? Are we working for the benefit of the general public, whom our Society is dedicated to serve? Have we, who have accepted responsibilities in the Society, fulfilled our obligations? What have we contributed towards making the world a better place in which to live?

Meeting and Exposition

Our next big contribution to the advancement of the Society's objectives in the realm of public service is the 61st Annual Meeting and the 12th Heating and Air Conditioning Exposition at Philadelphia next January 24-28. Our members are assured of an excellent technical program and our hosts of the Philadelphia Chapter, are prepared to take care of us in their usual hospitable manner.

This biennial Exposition is challenging, inspiring, and educational and it touches every man who looks upon it. It mocks the skeptic and inspires and assures the optimist.

It is not only a panorama of mechanical marvels — it is a demonstration of the skill, ingenuity, and achievement of the engineer who designed these marvels and of the production man who made them. It reflects the pride and enthusiasm of the salesman, and the faith and confidence of the financier.

This Exposition is a vast and colorful stage upon which the heating, ventilating, and air conditioning industry of this nation parades the symbols of its progress and the evidence of its faith in the future of America. Do not miss these important events which follow the holiday season.

The Officers, Members of Council, and our staff join me in extending Best Wishes for a very Merry Christmas and a Successful New Year.

Cordially yours,

L. N. Hunter

President

C. S. Leopold To Receive F. Paul Anderson Medal

The Council of the Society takes great pleasure in announcing the 13th Award of the F. Paul Anderson Medal to Charles S. Leopold, Philadelphia, Pa., in recognition of his outstanding contributions to the advancement of human comfort in the fields of heating, ventilating and air conditioning.

The award will be formally presented by Pres. L. N. Hunter at the 61st Annual Meeting of the Society at The Bellevue-Stratford, Philadelphia, Pa. on January 26, 1955.

Mr. Leopold established his office as a consulting engineer in 1923 and since 1926 a very large part of his practice has been devoted to air conditioning.

Professional Career

A native Philadelphian, Mr. Leopold was born on May 8, 1896. He received his preparatory education at Central High School and then attended the University of Pennsylvania, from which he received his B. S. in Electrical Engineering in 1917 and subsequently received a degree of E.E. During World War I he served as an ensign in the U. S. Naval Reserve.

Some of the buildings on which Mr. Leopold has designed and supervised the installation of heating and air conditioning are the Pentagon Building, Madison Square Garden, New York; the Bankers Life Building, Des Moines, Iowa; U. S. Capitol and Old House Office Building, the New York Stock Exchange and the Atomic Energy Commission, Los Alamos, New Mexico. In addition he has designed the air conditioning for many theaters, department stores, office buildings and for industrial processes.

Society Activities

Mr. Leopold has been an active member of the Society since he joined in 1934, serving as a member of the Society's Guide Committee for several years and as its chairman in 1945 for the 1946 edition of THE GUIDE. He has also served on many of the Society's Technical Advisory Committees, the Committee on Research and as a member of the Council. He is chairman of the TAC on Sensations of Comfort and has served as a member of the TAC on Physiological Reactions, TAC on Treatment of Disease, TAC on Radiation and Comfort, and TAC on Cooling Load in Summer.

As a member of the Philadelphia Chapter, Mr. Leopold also has been active serving on its legislative and meetings committees.

Among the papers he has presented at Annual and Semi-Annual Meetings of the Society are the aforementioned Tobacco Smoke Control, Conditions for Comfort, A Hydraulic Analogue for the Solution of Problems of Thermal Storage, Radiation, Convection and Conduction, and Design Factors in Panel Cooling and Air Cooling Systems.

Mr. Leopold has written extensively for *Heating, Piping and Air Conditioning; Refrigerating Engineering;* and contributed to the *Journal of the American Medical Association* and other scientific and technical publications.

Other Organizations

In addition to activity in the Society, Mr. Leopold also is a past president of the *American Society of Refrigerating Engineers* and a Fellow, *ASRE*, as well as Fellow, *Royal Society of Arts of Great Britain* and a member of the International Joint Committee on Psychrometric Data.

Mr. Leopold is listed in *Who's Who in Engineering* and is a member of Sigma Xi and Eta Kappa Nu.

Thirteenth Recipient of Award

Mr. Leopold is the thirteenth recipient of the F. Paul Anderson Medal which was established in 1930 by a gift of the late Thornton Lewis of Philadelphia who was president of the Society in 1929. Dean F. Paul Anderson of the University of Kentucky, for whom the Award is named, was ASHVE president in 1927.

The first award was made in 1932 to the late Dr. W. H. Carrier and other recipients of the Award have been Dr. A. Cutts Willard (1936); Prof. F. B. Rowley (1939); Dr. F. E. Giesecke (1942); Comdr. F. C. Houghten (1944); Capt. A. E. Stacey, Jr. (1946); J. H. Walker (1947). Dr. C.-E. A. Winslow (1949); S. R. Lewis (1951); Dr. Homer Addams (1952); E. N. McDonnell (1953); W. L. Fleisher (1954).

Members of the 1954 F. Paul Anderson Award Committee who nominated Mr. Leopold are John E. Haines, chairman; Lester T. Avery, Samuel R. Lewis, Lauren E. Seeley and Baldwin M. Woods.

Last Call for 61st Annual Meeting

JANUARY 24-27, 1955

BELLEVUE-STRATFORD HOTEL

Philadelphia

In a few short weeks Society members from all over the country will arrive in Philadelphia by plane, train and car to attend the 61st Annual Meeting of the Society and the 12th International Heating, Ventilating and Air Conditioning Exposition.

Chairman John McElgin of the Philadelphia Chapter Committee on Arrangements anticipates a record attendance, as the Housing Bureau is receiving a great number of reservations for hotel accommodations. This report, coupled with the fact that the Exposition will display over 400 exhibits of heating, ventilating and air conditioning equipment, indicates that Philadelphia will play host to a good percentage of the Society's membership as well as many others in the industry.

Of particular interest to ASHVE members will be the Society's informative exhibit at Booth 68 highlighting the research work done at the Society's Research Laboratory in Cleveland and at cooperating universities and other institutions. One of the demonstrations will be the use of the National Bureau of Standards' katharometer for measuring air infiltration. For the demonstration, a charge of helium is used as a tracer gas. Mixed with room air, the katharometer intermittently measures the helium content of a sample, indicating the change occurring as dilution is gradually produced by infiltration. The ASHVE display also will feature a centrifugal sedimentation apparatus developed by the University of Michigan for analyzing air contaminants as small as 1/100,000 of an inch by quantity, size and type. Still another of the displays in the exhibit will show that color does not affect heat reflectivity as it does light reflection. The backdrop of the Society exhibit at Booth 68 will feature the Research Laboratory program, ASHVE publications, membership growth, and some of the accomplishments of the Society's 60 years service.

The Exposition will open at 2:00 p.m., Monday, at the Commercial Museum, and remain open until 10:00 p.m. On Tuesday, Wednesday and Thursday, the hours will be from noon until 10:00 p.m. Friday, the final day of the Exposition, the hours will be noon until 6:00 p.m.

Interesting Papers Planned

Prof. B. H. Spurlock, Jr., chairman of the Program and Papers Committee, has announced that a total of 13 papers, which should be extremely interesting and stimulate lively discussion, will be presented at the four technical sessions.

Pres. L. N. Hunter will open the meeting January 24 at 9:30 a.m. in the Clover Room of The Bellevue-Stratford. One of the first papers will be concerned with the ventilation requirements for removing tobacco smoke; another will deal with the use of the general purpose centrifuge sedimentation method for measuring the size of dust particles, and the third will be a paper on evaluating panel-type air cleaners by means of atmospheric dust. E. F. Snyder will conduct the first technical session.

A report on how heat may be removed by using cooled-ceiling panels, and others on measuring angular emissivity, and the application of circuit analysis to load estimating, will follow the report of the Committee on Research by Chairman R. S. Dill on Tuesday morning.

PROGRAM — 61st ANNUAL MEETING

THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

January 24-27, 1955

Bellevue-Stratford Hotel, Philadelphia, Pa.

Saturday — January 22

2:00 p.m. Research Executive Committee

Sunday — January 23

10:00 a.m. REGISTRATION — Burgundy Room — Lobby Floor
10:00 a.m. Committee on Research
4:00 p.m. Welcome Tea — (Burgundy Room)

Monday — January 24

9:00 a.m. REGISTRATION — Burgundy Room — Lobby Floor
9:30 a.m. FIRST TECHNICAL SESSION — Clover Room
Call to Order by Pres. L. N. Hunter
Reports of Officers and Council
Amendments to By-Laws
E. F. Snyder, Jr., Chairman
Ventilation Requirements for Cigarette Smoke, by C. P. Yaglou
A Rapid General Purpose Centrifuge Sedimentation Method for Measurement of Size Distribution of Small Particles, by K. T. Whitby
Evaluation of Panel-Type Air Cleaners by Means of Atmospheric Dust, by H. A. Endres, W. T. Van Orman and R. P. Carter, Jr.
12:15 p.m. Welcome Luncheon — Ballroom — Bellevue-Stratford Hotel
Speaker: Hon. Joseph S. Clark, Jr., Mayor of Philadelphia
2:00 p.m. Ladies bus trip; Historic Philadelphia or Art Museum
2:00 p.m. EXPOSITION — Opening of 12th International Heating and Air Conditioning Exposition — Commercial Museum
Exhibit will close daily at 10:00 p.m. Monday through Thursday; will close Friday at 6:00 p.m.
ASHVE Booth No. 68
4:00 p.m. Chapters Conference Committee Meeting
6:00 p.m. Delaware Valley, U.S.A. Frolic; Buffet Supper, Show, Dancing (The Benjamin Franklin Ballroom)

Tuesday — January 25

9:00 a.m. REGISTRATION — Burgundy Room — Lobby Floor
9:30 a.m. SECOND TECHNICAL SESSION — Ballroom
Call to Order by Vice Pres. John E. Haines
Report of Committee on Research — R. S. Dill, Chairman
Preliminary Studies of Heat Removal by a Cooled Ceiling Panel, by L. F. Schutrum, John Vouris and T. C. Min
Measurement of Angular Emissivity, by A. Umur, G. V. Parmelee and L. F. Schutrum
Circuit Analysis Applied to Load Estimating, Phase II, by H. B. Nottage and G. V. Parmelee
Report of Tellers of Election
11:00 a.m. Ladies Luncheon and Bus Trip to Longwood Gardens
12:00 noon EXPOSITION — 12th International Heating and Air Conditioning Exposition — Commercial Museum
2:00 p.m. Chapters Conference Committee Meeting
7:00 p.m. Past Presidents' Dinner — Union League Club

Wednesday — January 26

9:00 a.m. REGISTRATION — Burgundy Room — Lobby Floor
9:30 a.m. THIRD TECHNICAL SESSION — Ballroom
Call to Order by Second Vice Pres. John W. James
Prof. E. R. Queer, Chairman
Gas is an Important Factor in the Thermal Conductivity of Most Insulating Materials, Part II, by R. M. Lander
Selection of Outside Design Temperature for Heat Load Estimation, by M. L. Ghai and P. Sundaram
Study of Liquid-to-Liquid Heat Transfer in Hot Water Heaters, by F. W. Hutchinson, L. J. La Tart and N. W. Smith
Solar Radiation During Cloudless Days, by J. L. Threlkeld and R. C. Jordan
12:00 noon EXPOSITION — 12th International Heating and Air Conditioning Exposition — Commercial Museum
12:30 p.m. Ladies Luncheon and Fashion Show (Warwick Hotel — Ballroom)
2:00 p.m. Nominating Committee Meeting
7:00 p.m. Banquet (Bellevue-Stratford — Ballroom)
Speaker: Dr. Milton Eisenhower, President, Pennsylvania State University
Installation of Officers
Presentation of Past President's Emblem to L. N. Hunter by M. F. Blankin
Presentation of F. Paul Anderson Medal to C. S. Leopold by L. N. Hunter

Thursday — January 27

9:00 a.m. REGISTRATION — Burgundy Room — Lobby Floor
9:30 a.m. FOURTH TECHNICAL SESSION — Ballroom
Call to Order by Pres. L. N. Hunter
Prof. Linn Helander, Chairman
Paths of Horizontally Projected Heated and Chilled Air Jets, by Alfred Koestel
Air Conditioning of Multi-Room Buildings, by R. W. Waterfill
Effects of Weather Conditions on Cooling Unit Operation in a Residence, by H. T. Gilkey and S. Konzo
Report of Committee on Resolutions
Unfinished Business
New Business
Adjournment
10:00 a.m. Ladies Bus Trip to Atlantic City; Luncheon (Haddon Hall — Wedgewood Room) Boardwalk Sightseeing
12:00 noon EXPOSITION — 12th International Heating and Air Conditioning Exposition — Commercial Museum
1:00 p.m. Organization Meeting of 1955 Council

Friday — January 28

12:00 noon EXPOSITION — 12th International Heating and Air Conditioning Exposition (Commercial Museum — Closes at 6:00 p.m.)

A.S.H.A.E.

By their votes the members of A.S.H.V.E. have spoken emphatically in favor of a new name — AMERICAN SOCIETY OF HEATING AND AIR-CONDITIONING ENGINEERS, INC. At the Special Meeting of the Society in the Hotel Statler, New York at 2 p.m. Monday, November 22, the tellers reported the vote as follows:

TOTAL VOTES CAST	4081
In favor of Name Change	3280
Opposed to Name Change	654

The decision was made by a majority of the membership eligible to vote and the vote was surprisingly heavy with a total of 4081 ballots cast. The new name has been filed with the Secretary of State of the State of New York.

A.S.H.A.E. is dedicated to carry on the traditions and enlarge the scope of the worthwhile services visualized by the founding fathers 60 years ago, for the advancement of the arts and sciences related to heating, ventilating, cooling and air conditioning and the allied arts and sciences.

The Society has established an enviable performance in the past and has a glorious future before it. Here's to the success of the A.S.H.A.E.

Prof. E. R. Queer will be chairman of the Wednesday morning technical session when papers will be offered on the importance of gas as a factor in the thermal conductivity of most materials, how selecting outside design temperature can aid in estimating heat load, and a study of liquid-to-liquid heat transfer. The final paper will be a report on radiation on cloudless days.

The final technical session, Thursday morning, will include a paper on the paths of horizontally projected heated and chilled air jets, another on the air conditioning of multi-room buildings, and the final paper will be an explanation of how weather conditions affect residential cooling unit operation. The chairman of this session will be Prof. Linn Helander.

Arrangements Committee Plans

John McElgin, general chairman of the Committee on Arrangements, reports that beginning Sunday afternoon with a Welcome Tea in the Burgundy Room of the Bellevue-Stratford at 4:00 p.m., the committee has arranged for social activities for each day of the Annual Meeting. At 12:15 p.m. on Monday, there will be a Welcome Luncheon, and in the afternoon, bus tours to historic places are available for the ladies. Monday evening, the Delaware Valley, U.S.A. Frolic will be presented in the Hotel Benjamin Franklin Ballroom. Beginning at 6:00 p.m. this buffet supper, show and dance promises to provide an evening of pleasant relaxation. On Tuesday there will be a luncheon and bus trip to Longwood Gardens for the ladies. Wednesday, a fashion show and luncheon has been planned for the ladies, and this will be held in the Warwick Hotel Ballroom at 12:30 p.m.

CARPENTERS' HALL

The annual banquet at 7:00 p.m. Wednesday evening in the Bellevue-Stratford Ballroom will climax the week's activities by offering Dr. Milton Eisenhower, president of Pennsylvania State University, as the speaker. In addition, there will be the installation of officers, the presentation of the F. Paul Anderson Medal, to Charles S. Leopold of Philadelphia by Pres. L. N. Hunter, and the ceremony bestowing the Past President's Emblem upon L. N. Hunter, retiring president, by M. F. Blankin. A. J. Nesbitt, Philadelphia, will be the toastmaster.

In addition to meetings of the Council, the Committee on Research, and numerous technical advisory committees, the Chapters Conference Committee has two sessions scheduled. The organization meeting of the Nominating Committee will be held and the past presidents will hold their customary Dinner on Tuesday.

Post-Meeting Tours

Arrangements have been made for two Bermuda tours, one by air leaving Thursday afternoon Jan. 27 and the other by boat leaving Saturday, Jan. 29. The complete itineraries have been mailed to members, and those who have not made reservations should communicate with Leon V. Arnold, Holley Chambers, 33 Washington Square, New York 11, N. Y., for boat reservations, and for air, Joseph Sims, Raymond-Whitcomb Travel Service, 1600 Walnut St., Philadelphia 3, Pa.

The Bermuda cruise is scheduled for departure from New York at 5 p.m. January 29 on the Ocean Monarch, arriving at Bermuda January 31 at 9 a.m. with accommodations at the Hotel Princess. Departure for New York, after a pleasant holiday in Bermuda, is at 3 p.m. on February 3, arriving in New York, February 4 at 9 a.m.

Those preferring air travel will enjoy the arrangement by the committee for reservations by plane from New York. The plane will leave New York Thursday afternoon arriving in Bermuda that evening. Accommodations will be reserved at the Elbow Beach Hotel. Departure for New York will be Sunday, January 30.

Summary of

• *ARKANSAS*: A membership drive was the subject of discussion at the September meeting presided over by Pres. R. E. Blaylock. F. L. Cumnock introduced the guest speaker, Tom Loberg, vice president, Cook & Nichol Co., Memphis, who presented many interesting facts on *Residential Heating and Cooling*.

• *ATLANTA*: Following discussion at the September meeting, general opinion of the redistribution of regional areas was favorable, but the proposal to send Chapter delegates to regional rather than national annual meetings was viewed as impractical and unfavorable. Elected to the Chapters Conference Committee were T. A. Barrow, Jr., delegate, and F. W. Bull, alternate.

H. W. Alyea, development and field engineer, Johnson Service Co., Milwaukee, was introduced by S. L. North and spoke on new development in controls. Attendance 60.

• *BRITISH COLUMBIA*: Lengthy debate on the proposed change of Society name and the defeat of a motion of approval resulted in a written request for deferment of voting. Also at the October meeting, D. W. Thomson was presented with the *A S R E Air Conditioning Data Book* (Design Volume) in appreciation for a talk he gave before the local *ASRE* chapter.

Mr. Thomson introduced the guest speaker, Dr. L. W. Schemilt, who spoke on *Corrosion*, outlining the fundamental relationships between rate of corrosion and pH. Attendance 48. Attendance ratio 0.59.

• *CINCINNATI*: Two speakers graced the Cincinnati Chapter October meeting held under the chairmanship of R. S. Rose. Second Vice Pres. J. W. James, Chicago, gave an inspiring talk entitled *Give the Public What They Need*. Previously, Dean C. A. Joerger, University of Cincinnati, spoke on the *Objectives of the Modern Engineering Colleges*.

Business of the meeting included the election of F. W. Wilson as delegate and A. H. Gerdsen as alternate to the Annual Meeting in January. Following a report by A. W. Edwards on the proposal to include the words *air conditioning* in the Society name, a great majority, although not agreeing on the exact form, favored the change. Attendance 52. Attendance ratio 0.38.

C. V. Bangston, president of Delta Chapter, and C. B. Gamble, guest speaker, at recent Delta Chapter meeting.

• *DELTA*: Delta Chapter opened its 1954-55 season on September 21, 1954, with the largest crowd in the history of the Chapter. A tour of the air conditioning installation at the New Orleans office of the Gulf Refining Co. preceded the call to order by Pres. C. V. Bankston.

C. B. Gamble of the firm of Cary B. Gamble & Associates, New Orleans, was introduced by Theodore Offner, technical papers chairman. Mr. Gamble gave an excellent presentation on the design and installation of the air conditioning system in the building through which the tour was conducted. Attendance 85. Attendance ratio 0.46.

• *EMPIRE STATE CAPITAL*: ASHVE Pres. L. N. Hunter, Johnstown, Pa., received a rousing ovation when he was introduced to the October meeting by R. D. Marshall, whose father had introduced President Hunter at past meetings. President Hunter gave an interesting presentation on *The Rating of Heating Boilers*.

The Society President joined Pres. E. C. Doyle in urging the members to vote on the proposed name change. H. S. Bond, program chairman, distributed printed copies of the season's program. Attendance 45. Attendance ratio 0.45.

• *INLAND EMPIRE*: R. C. Chewning, assistant, J. Donald Kroeker & Assocs., Portland, Ore., outlined the history of the *Heat Pump or Reverse Cycle Heating and Cooling*. Introduced at the September meeting by K. M. Wood, Mr. Chewning explained the principles which make reverse cycle heating possible. He stressed that the heat pump pays only when it is efficient and that the coefficient of performance is very critical. He considers the system's greatest asset to be the single cost of both heating and cooling.

A membership book listing speakers and dates for the coming year was given to the members by Vice Pres. F. W. Jenkinson. Pres. H. A. Bickel announced the addition of 13 new members. Attendance 23. Attendance ratio 0.34.

• *KANSAS CITY*: *A Common Sense Approach to Modern Air Distribution Systems* was the subject of a talk by H. H. Yousoufian, research engineer, Air Devices, Inc., New York, N.Y. Mr. Yousoufian, giving particular attention to new and unusual types of air diffusers, was well received at the October meeting where he was introduced by D. M. Allen.

A motion was carried that the Chapter recommend a partial change in the Society name from *Ventilating* to *Air Conditioning* or *Ventilating and Air Conditioning*. A resolution was adopted to ask the Kansas City Power & Light Co. to raise the size limitation on single phase residential air conditioning motors sufficiently to permit the installation of air conditioning units of three-ton nominal capacity. Attendance 114. Attendance ratio 0.36.

• *MICHIGAN*: An instructive talk on *Package Boilers* was given in October by J. B. Johnson, regional manager, Industrial Division, York-Shipley, Inc., York, Pa.

In the absence of R. L. Spitzley, J. H. Spitzley accepted his father's Life Membership Certificate from Pres. E. F. Glanz. Attendance 196. Attendance ratio 0.62.

• *MINNESOTA*: Dealing with the economies, advantages, and limitations of *Residential Air Conditioning*, G. J. Svoboda, Carrier Corp., spoke at the October meeting.

Membership approval was given to the extension of an invitation to the Society to hold the 1958 Semi-Annual meeting in Minneapolis. G. F. Gausman, program chairman, introduced several new members. Attendance 149.

• *NEBRASKA*: At the October business meeting, there was discussion of the proposed Society name change, the 1954-55 program, and a drive for new members. M. F. Stober, program chairman, received a number of good suggestions on possible programs. E. N. Seiler, membership chairman, proposed a contest for the acquirement of the most new members. It was voted that a meeting for membership only be held each September for the discussion of the Chapter business for the forthcoming year. Attendance 26.

• *NEW MEXICO*: Elected to the Chapters Conference Committee were R. W. Haines, member, and J. K. James, alternate. Also at the October meeting, a motion was passed that Secretary James notify Council that all members present were in favor of the proposed change in the name of the Society.

C. R. Wherritt introduced the speaker, R. C. Smith, who gave an interesting talk on Los Alamos' part in the atomic energy program. Attendance 26.

• *NEW YORK*: Speaking on *The Rating of Heating Boilers* at the October meeting, ASHVE Pres. L. N. Hunter, Johnstown, Pa., explained the meaning of ratings as established by *IBR*, *SBI*, *AGA*, and *HP&ACCNA* codes and showed how the ratings were established from the tests conducted according to these codes. Albert Giannini, program chairman, introduced President Hunter, who also emphasized the importance of prompt voting on the proposed ASHVE name change.

Nathan Feder, membership chairman, listed 15 new members, and Pres. R. L. Stinard introduced W. C. Jewell, guest member from East Melbourne, Australia. Attendance 120. Attendance ratio 0.24.

• *NORTH JERSEY*: P. B. Gordon, Council member, at the October meeting explained the reasons prompting the suggested change of name of the Society. Pres. H. M. Patrick reported an average attendance of 55 percent during the past year.

Modern Trends in Air Distribution was the subject of the guest speaker, W. L. Batchelor, assistant chief engineer, Tuttle & Bailey, Inc., New Britain, Conn. A lengthy question and answer period followed. Attendance 75.

• *OKLAHOMA*: Louis Loeffler, Jr. introduced W. H. Plowman, Goulds Pumps, Inc., Tulsa, to the October meeting. Mr. Plowman spoke on the application of centrifugal pumps to air conditioning systems, covering some problems encountered in pump design and trends in use. The talk was illustrated with slides including typical piping circuit for condensing water pumps, pump curves and tables of pump performance.

Pres. G. E. Ervin introduced the new officers and A. R. Morin reported on the 1954-55 program. Attendance 54. Attendance ratio 0.51.

• *OREGON*: Balloting for the nominating committee resulted in election of J. P. McDermott, chairman, B. W. Farnes, J. D. Kroeker, T. H. McClung and T. E. Taylor. Also at the meeting in October, revisions in the chapter by-laws were unanimously accepted. Pres. E. E. Kelly announced the appointment of a special Chapter manual committee to prepare an operational guide.

P. W. Aitkenhead, president, Electro-air Cleaner Co., Pittsburgh, was introduced by J. P. McDermott and gave a stimulating talk on the history and development of electrostatic precipitators, including testing methods and applications. Attendance 74. Attendance ratio 0.36.

• *PHILADELPHIA*: *Water Can Change Its Mind Too* was the provocative title of a talk by Fred Hodgdon, chemical engineer, Carrier

Corp., Syracuse, N. Y., given in October. Society Pres. L. N. Hunter, Johnstown, Pa., extended greetings from the ASHVE officers and spoke on the budget for the coming year.

John Everetts, Jr., vice chairman, Committee on Arrangements, Annual Meeting, advised that all Philadelphia Chapter members are being placed on committees and each member is expected to do his part for the success of the Meeting. He also stressed the importance of securing contributions for research. Attendance 84. Attendance ratio 0.30.

• *PITTSBURGH*: The annual joint *ASRE*-ASHVE meeting in October was under the chairmanship of W. A. Siegfried, *ASRE*. After the introduction of the officers of both groups, the chairman presented G. S. Jones, Jr., managing director, Air Conditioning and Refrigeration Institute, Washington, D. C. Speaking on *Air Conditioning, Today and Tomorrow*, he advised consideration of the present condition rather than calendar date; premature shutting down of a unit makes a bad situation. He also discussed future economy in use of water in air conditioning and education of the public on what air conditioning ought to be. Attendance 52.

• *ROCKY MOUNTAIN*: At the 10th anniversary meeting in October, Pres. V. F. Vallero introduced the past Chapter presidents. H. H. Yousoufian, research engineer, Air Devices, Inc., New York, gave an informative talk on air distribution, covering continuous strip, circular, square and rectangular diffusers and field testing of diffusers. In answering questions following the talk, Mr. Yousoufian showed a practical approach to his subject.

Announcement was made of the appointment of E. L. Heckman as a member delegate to the Colorado Engineering Council for 1955, with J. W. Braak as alternate.

• *SACRAMENTO VALLEY*: Prof. Edwin Weinberg, Sacramento State College, was introduced to the October meeting by R. A. Sarro. Professor Weinberg announced that the College will soon inaugurate a research program. Varying opinions were expressed on the proposed project, *An Investigation of the Load Characteristics of the Heat Pump in the Cooling Season in the Sacramento Area.*

Pres. J. E. Marshall presented a past president's pin to E. C. McKinsey in recognition of the fine work done during his term in office. Attendance 56. Attendance ratio 0.48.

• *ST. LOUIS*: Prof. E. R. Queer, Pennsylvania State University, State College, Pa., explained in October that the officers wished to encourage everyone to vote on the proposed Society name change, and reported on the Council meeting in Indianapolis, October 8th.

E. T. Clucas, program chairman, introduced Carter Lewis, chief illuminating engineer, Union Electric Co., who spoke on *Light and Air Conditioning*, describing a definite relationship between the two since optimum lighting in stores and offices necessarily requires air conditioning. He showed slides indicating the direction and intensity of light rays from various types of lamps, and numerous lighting arrangements in different offices.

An affirmative vote established changes in the Chapter by-laws. Attendance 52.

• *SHREVEPORT*: Pres. J. S. Malahy, Jr. was elected delegate to the Chapters Conference Committee with A. L. Jones, Jr. as alternate. Discussion on the report made to Council by the Chapter Relations Committee concerning the redistricting of regional areas was led by Secy. H. E. Scott at the September meeting, with explanations by President Malahy and W. E. FitzGerald of the consequences involved. There followed a unanimous vote in favor of the entire report. President Malahy, during a general discussion on ways of bettering Chapter functions, urged an active membership committee. By acclamation it was decided to mail copies of The Flue Pipe, the Chapter paper, to nonmembers to help the attendance and membership committees. Attendance 32. Attendance ratio 0.62.

• *SOUTH TEXAS*: Charles Blume, Houston Lighting & Power Co., speaking at the September meeting, outlined the growth of power facilities in rapidly expanding Houston. Mr. Blume was introduced by E. B. Appling.

Business of the meeting included discussion by Reg. F. Taylor on the proposed Society name change and the Council resolutions on regional meetings and redistricting, and a report by C. L. Fleming on the Giesecke Memorial Fund. Pres. J. W. Holland covered the last Semi-Annual Meeting. Attendance 68. Attendance ratio 0.29.

• *SOUTHERN CALIFORNIA*: *Evaporative Cooling*, according to S. F. Duncan, director of research, Farr Co., Los Angeles, is amenable to design treatments given to the better known cooling and heating problems. In his talk before the October meeting, Mr. Duncan discussed the field of application of evaporative cooling, its capabilities and limitations, and stressed the need for engineers to understand that evaporative cooling equipment has progressed in quality to the point where its specification and sizing and the design of the installation merit consideration equal to other cooling systems. Mr. Duncan, who was introduced by J. R. Hall, program chairman, concluded by saying that evaporative cooling is really a rediscovery of an old idea, first crude and unpredictable, now polished and predictable as it operates under known laws.

• *UTAH*: Dr. Mervin Hogan, head of the mechanical engineering department, University of Utah, made an impressive case for the belief that a university's aim should be to make a better man, not just prepare for a specific job. Speaking in September on *New Developments in the Engineering Curricula,* Dr. Hogan said that many frills of modern education could be eliminated in favor of a more rounded, basic, classical grounding in the fundamental human studies and the engineering sciences. He suggested that industry knows best what technical details it wants new employees to learn and advocated that the colleges leave these details up to the employer.

Pres. A. A. Maycock outlined the proposal to change the Society name of regions and related changes. The proposals on alteration of the number was also presented, and although the members understood why a change might become desirable, it was not popularly received. Attendance 11. Attendance ratio 0.27.

- *VIRGINIA*: Pres. H. E. Marquart presided at the September meeting held at The Pine Tree Inn. Guest speaker for the evening, Floyd Hasselriis, American Hydrotherm Corp., Long Island City, N. Y., gave an interesting talk on high temperature water for heating. Attendance 32. Attendance ratio 0.66.

- *WASHINGTON, D. C.*: A well presented discussion on the *Design, Rating and Performance of Extended Surface Coils* was given by F. G. Myers, chief engineer, Marlo Coil Co., St. Louis, Mo., in October. He specifically mentioned materials of construction, theory of coil heat transfer, methods of testing and rating, heating and cooling agents, and design and engineering of coils. D. J. Wood introduced the speaker.

Pres. G. C. F. Asker announced the proposal to change the name of the Society, and each member was given a mimeographed copy of Mr. Hutchinson's letter. After the meeting, colored motion pictures of the September annual picnic were shown. Attendance 74. Attendance ratio 0.38.

- *WEST TEXAS*: The guest speaker at the September meeting was R. L. Patton, branch commercial manager, Minneapolis-Honeywell Regulator Co., Dallas. He spoke on the use of electronic devices as applied to the field of temperature controls. Pres. L. C. McKay presided. Attendance 25. Attendance ratio 0.33.

- *WISCONSIN*: Pres. L. C. Plaehn reported in September on the proposed engineering center which is under consideration by the Society, the proposal for Society name change, and the matter of redistricting the United States and Canada. A committee was appointed to consider and report on this last proposition. A motion was carried that the unapproved by-laws be brought before the membership for correction.

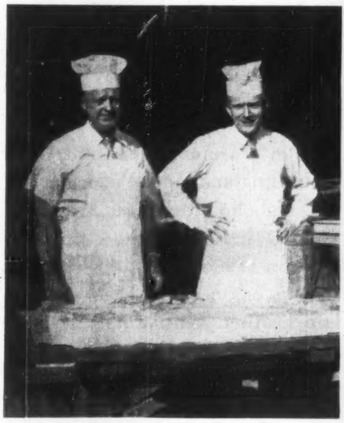
C. H. Randolph introduced C. J. Coddell, member of the Wisconsin Industrial Commission, who discussed the State Heating, Ventilating and Air Conditioning Code, pointing out that Wisconsin was one of the first states to adopt a code governing heating and ventilating. Attendance 101. Attendance ratio 0.41.

STUDENT BRANCH

- *PURDUE UNIVERSITY*: Pres. E. B. Katz presided at the September meeting held at the home of F. B. Morse, faculty advisor. Possible future activities were discussed: field trips, guest speakers, and attendance at meetings of the Indiana Chapter. Nine applications for membership were made. Attendance 16. Attendance ratio 0.78.

Washingtonians Get Together

The second annual picnic of the Washington, D. C. Chapter was held on September 25 at Battery Kemble Park in northwest Washington. Over 100 members and guests with wives and children enjoyed the perfect weather.



Washington, D.C. "Chefs" H. G. Carlton and J. S. King ready and waiting.

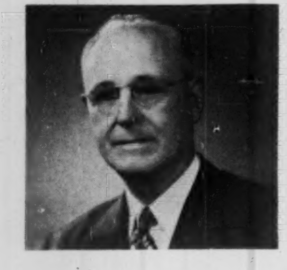
W. C. Reamy, Jr., G. C. F. Asker and J. G. Muirhead relax at Washington, D.C. Chapter's picnic at Battery Kemble Park.

A hard-fought baseball game resulted in the defeat of Captain N. M. Love's team, the "Dogs", by Captain S. R. Allen's team, the "Cats". Pres. G. C. F. Asker presented the winning team with a "Rube Goldberg" heating and ventilating trophy made by Chapter members. There were also horseshoes, badminton and children's activities. At sunset, everyone gathered to enjoy the food.

The popularity of this affair seems to be well established. The attendance more than doubled that of last year.

Honored by Life Membership

Chandler C. Cohagen, Billings, Mont. — A member of the Society since 1919, Chandler C. Cohagen was graduated from the College of Architecture, University of Michigan in June 1915 with the degree of Bachelor of Architecture. Although born near Pierson, Iowa on April 24, 1889, Mr. Cohagen has spent most of his time in Billings, Montana in professional practice as president of McIver, Cohagen & Marshall from 1915 to 1920 and president of McIver & Cohagen from 1920 to 1936. Since 1936 he has been in practice as Chandler C. Cohagen except for during World War II when he was chief architect at Eau Claire and Muscatine for Smith, Hinchman & Grylls of Detroit.

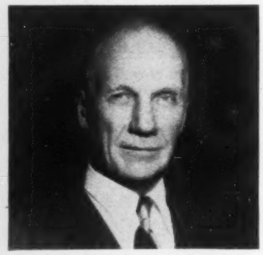


C. C. Cohagen
Billings, Mont.

He became a Fellow of *AIA* in 1951, was president of the Montana Chapter, *AIA*, for eight years and a member of the State Board of Architectural Examiners for 29 years. He is cofounder of Alpha Rho Chi and a member of Delta Phi and Tau Sigma Delta. Active in a number of other organizations, Mr. Cohagen also has been president of the Billings YMCA for 29 years and is a past president of the local Chamber of Commerce and Kiwanis. He is vice president of the *Billings Polytechnic Institute*.

Irving C. Jennings, South Norwalk, Conn. — President of the Nash Engineering Co., South Norwalk, Mr. Jennings was born in this same community July 27, 1884 and it has been his home ever since.

Following graduation from New York University in 1906 with B. S. and M. E. degrees he was associated for a few years with Reed & Stem-Warren-Wetmore, Associate Architects in the construction of Grand Central Terminal, New York. He served as assistant mechanical engineer working on heating, ventilating and all mechanical equipment above the tracks.



I. C. Jennings
South Norwalk, Conn.

Joining Nash Engineering Co. in 1909, he became chief engineer in 1910. Mr. Jennings advanced to general manager in 1912 and director in 1913. From 1915 to 1923, when he became president, he served as vice president. Mr. Jennings is also president of Nash Engineering Co. of Canada, Ltd. and chairman of the Board of Directors of Nash Engineering Co. (Great Britain) Ltd., Croydon. He joined the Society in 1924, including membership in both the New York and Connecticut Chapters.

Mr. Jennings is a member of *ASME, ASRE, National Society of Professional Engineers, American Ordnance Association, National Security Industrial Association* and others. He is also a member of the Engineers Club and Zeta Psi Club, New York. Fraternities and honor societies include Phi Beta Kappa, Zeta Psi, Tau Beta Pi and Iota Alpha.

Reg. F. Taylor, Houston, Tex. — President of the Society last year, Mr. Taylor has served both the Society and local Chapters since 1915 when he became a charter member of the Kansas City Chapter. He was living in Dallas in 1937 at the time the Texas Chapter was organized and served as its president. Later when it was divided into the North Texas and South Texas Chapters Mr. Taylor served as president of the South Texas Chapter in 1939. He also served on its board of governors in 1940, 1943 and 1944 and on numerous committees.

Reg. F. Taylor
Houston, Tex.

Elected to the Society's Council he served a three-year term from 1947 to 1949. Elected treasurer in 1950, Mr. Taylor then successively was elected second vice president in 1951, and first vice president in 1952. He has served as chairman of the following committees: — Special Committee on Chapter Relations, 1947; Membership, 1948; Program and Papers, 1949; Finance, 1951 and ex-officio, Executive Committee, 1950; Finance, 1950, and Ways and Means, 1951.

Born in Toronto, Ont. and educated in England and Pietermaritzburg, Natal, South Africa, Mr. Taylor entered the United States through Canada in 1908. Now a Houston consulting engineer, he has specialized in heating, ventilating, air conditioning and electrical design for various buildings primarily in Texas, Louisiana, Oklahoma, Arkansas, Alabama, Arizona and Missouri. A registered professional engineer in the State of Texas, he is a member of the *Texas Society of Professional Engineers, American Institute of Electrical Engineers,* Houston Engineers Club, Rotary and others.

Fred G. Weimer, Milwaukee, Wis. — From the age of 14, Mr. Weimer has been employed by the Kewanee-Ross Corp., previously known as Kewanee Boiler Co., Kewanee, Ill.

Born in Spring Valley, Ill., on August 31, 1889, Mr. Weimer was raised in Kewanee. He attended business college at night. In 1919, when he became a member of the Society, he was sales manager of the Milwaukee office, Kewanee Boiler Co. Approximately 37 of his 51 years with the company have been spent in Milwaukee where he has his residence.

As an active member of the Wisconsin Chapter, Mr. Weimer served as secretary, 1927, vice president, 1929, president in 1930, and member of the board of governors, 1931-32.

Carl A. Weiss, Kansas City, Mo. — President of his own company, Carl Weiss & Co., since about 1950, Mr. Weiss formerly was with the Kornbrodt Kornice Co., Kansas City, Mo. for over 40 years in the capacities of superintendent and manager handling such projects as the ventilation and air conditioning sheet metal construction for the Kansas City Municipal Auditorium.

Born in Schmalkalden, Germany, April 8, 1885, he migrated to the United States at the age of 18 becoming a citizen a few years later. He became associated with the Kornbrodt Kornice Co. in 1909 and is a resident of Kansas City since that time. Among the many prominent installations Mr. Weiss has worked on are the Kansas City City Hall, the U. S. Post Office Building, Federal Courts Building, Pratt-Whitney Corp. plant and the Hallmark Cards plant.

A member of the Society since 1924, Mr. Weiss served as the president of the Kansas City Chapter in 1935-36. He also is a member of the Kansas City Rotary and the Engineers Club. When not otherwise engaged by business he enjoys relaxing with such hobbies as fishing and outdoor work.

Candidates for Membership

The Society's By-Laws require that all applications for membership or advancement are to be sent to the Executive Secretary and the names of applicants and their references shall be printed in the next issue of the Journal of the Society, or mailed to all members. When the replies are received from references the Candidate's application shall be submitted to and acted upon by the Admission and Advancement Committee as soon as possible.

When the Admission and Advancement Committee has acted favorably upon a Candidate's application and assigned his grade, the Council shall confirm the election of the proposed Candidate for membership. During the past month there have been 72 applications for membership, including 25 students, 6 reinstatements; in addition 23 advancements have been received. The names of these men and their sponsors are published in the following list.

Members are requested to scrutinize the list with care. The Admission and Advancement Committee, and in turn, the Council, urge members to assume their share of responsibility of receiving these candidates into membership by advising the Executive Secretary promptly of any whose eligibility for membership is in any way questioned.

All correspondence in regard to such matters is strictly confidential, and is solely for the good of the Society, which it is the duty of every member to promote.

Unless objection is made by some member by December 31, 1954, these candidates will be voted upon by the Council. Those elected to membership will be notified by the Executive Secretary immediately after election.

Note: †Reinstatement. *Non-member. △Advancement.

Arkansas

Link, R. R., Construction Engr., General Air Conditioning Corp., Little Rock. References: J. L. Brown, H. H. Himstedt, J. C. Lewis, C. H. Miller.

California

Adams, R. L., Jr., Mech. Engr., Howard F. McCandless, Cons. Mech. Engr., Fresno. References: R. D. Knowles, N. N. Leas, H. F. McCandless, D. L. Williams.

Breidert, G. M., Secy.-Treas., The G. C. Breidert Co., San Fernando. References: I. W. Cotton, N. N. Dahl, N. H. Peterson, H. P. Sheldon.

△Newman, C. T., Engr., Air Comfort Inc., South Gate. References: Paul Bradfield*, A. J. Hess, Joseph Kiskis*, Clare Smallcomb*.

Whitehead, S. G., Sales Engr., Lennox Furnace Co., Pasadena. References: W. P. Cohen, L. R. Kleinberg, George Rusher, Clarence Stumpf*.

Connecticut

Allaire, E. E., Bldg. Maintenance, Southern New England Telephone Co., Waterbury. References: R. C. Atherton, W. A. Ellis, W. A. Johnson, A. J. Lawless.

JOURNAL SECTION

NEEKAMP, W. H., Repr., Anemostat Corp. of America, Hartford. REFERENCES: Fritz Honerkamp, F. J. Kurth, E. A. McArdle, L. R. Phillips.

SINICHKO, GEORGE, Chief Appl. Engr., The Bush Manufacturing Co., West Hartford. REFERENCES: D. L. Adkins*, C. L. Babin*, Cecil Boling*, J. A. Mulcahey*.

District of Columbia

HELLMAN, RICHARD, Business Economist, U. S. Department of Commerce, Washington. REFERENCES: P. R. Achenbach, J. J. Chaconas, Sr., R. S. Dill, J. G. Muirheid.

LUDKE, W. D., Master Plumber, W. A. Ludke & Sons, Washington. REFERENCES: J. J. Chaconas, Sr., J. P. Conner*, A. B. Devore, Barney Menditch.

WELCH, M. A., Owner, Matthew A. Welch & Sons, Washington. REFERENCES: J. J. Chaconas, Sr., J. P. Conner*, A. B. Devore, Barney Menditch.

Georgia

STRICKLAND, W. C., Owner, Walter Strickland Co., Atlanta. REFERENCES: H. A. Ammons, H. R. Bryant, F. W. Bull, J. M. Lazenby.

Illinois

△CARROLL, J. R., Asst. Prof. Mech. Engrg., University of Illinois, Urbana. REFERENCES: H. D. Bareither, J. R. Fellows, S. Konzo, R. J. Martin.

△OBERLIN, J. A., Chief Engr., National Korectaire Co., Chicago. REFERENCES: J. C. Scott, E. E. Sundeen, E. R. Teske, G. V. Zintel.

O'DONOHUE, W. T., Field Service Engr., A. M. Byers Co., Chicago. REFERENCES: G. W. Bornquist, H. G. Chapin, G. B. Coffey, A. O. May.

△STIGGLEMAN, J. H., Asst. Chief Mech. Engr., Childs & Smith, Arch. & Engrs., Chicago. REFERENCES: M. W. Bishop, H. J. Couch, C. R. Kuglin, R. O. Nelson.

Indiana

△MORSE, F. B., Asst. Prof., Purdue University, School of Mech. Engrg., Lafayette. REFERENCES: P. R. Jordan, W. T. Miller, A. O. Roche, G. B. Supple.

POLSTON, A. C., Foreman, Sheet Metal Dept., E. I. Dupont de Nemours Co., Charlestown. REFERENCES: W. A. Branson*, A. E. Hausmann, J. W. May, Arthur Nutting.

△RAY, G. E., Chief Engr., Peerless Furnace and Foundry, Inc., Indianapolis. REFERENCES: R. C. Blackman, I. W. Cotton, C. F. A. Locke, G. W. Vogel.

WADE, G. L., Field Engr., M & E Mfg. Co., Indianapolis. REFERENCES: Sidney Fenstermaker, Jr., C. F. A. Locke, F. G. Phelps, G. W. Vogel.

Kansas

BRUCE, J. R., Br. Mgr., The Powers Regulator Co., Wichita. REFERENCES: O. P. Bullock, A. P. Francis, R. L. Kilker, R. M. Spencer.

ROBINSON, J. J., Heating Engr., Kendall Plumbing Co., Wichita. REFERENCES: G. G. Foulds, A. P. Francis, E. E. Hysom, G. L. Oswald.

STEPHENS, P. J., Estimator, Ripstra Turner Co., Wichita. REFERENCES: R. F. Bauer, Charles Dodds*, A. P. Francis, R. L. Pennington.

Kentucky

AKINS, M. M., Sales Engr., American Air Filter, Louisville. REFERENCES: J. M. Kane, W. J. Killian, J. W. May, H. J. Noles.

BONN, D. E., Supvsg. Engr., American Air Filter Co., Inc., Louisville. REFERENCES: J. M. Kane, J. W. May, H. J. Noles, Arthur Nutting.

BRUMFIELD, L. L., Sr. Engr., E. I. du Pont de Nemours & Co., Louisville. REFERENCES: J. B. Bolen, H. C. Hartman, Jr.*, A. E. Hausmann, C. F. Mallory*.

HALL, T. D., Engr., Jackson Engineering Co., Louisville. REFERENCES: S. E. Fenstermaker, J. T. Hardin, J. W. Jackson, P. O. Patterson.

HOLMES, L. M., Field Engr., Griffin & Co., Louisville. REFERENCES: O. J. Hill, J. M. Kane, J. W. May, D. J. Rank.

VAN ETTEN, ARNOLD, Vice Pres. Engrg., Griffin & Co., Louisville. REFERENCES: W. J. Griffin*, O. J. Hill, J. W. May, D. J. Rank.

VEATH, B. M., Design Engr., American Radiator and Standard Sanitary Corp., Louisville. REFERENCES: R. B. Duggan, F. E. Hanson, L. L. Smith, J. B. Uhl.

Louisiana

TARLTON, J. S., Engr., Shreveport Plumbing Co., Inc., Shreveport. REFERENCES: C. M. Hadra, M. A. Hudson, J. S. Malahy, H. E. Scott.

Maryland

KNOLL, M. B., Plant Design Engr., Glenn L. Martin Co., Baltimore. REFERENCES: R. E. Dressel, E. J. Dull, C. B. Mitchell, E. H. Taze.

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△WEISMAN, R. F., Mgr., Air Cond. Dept., Lloyd E. Mitchell, Inc., Baltimore. REFERENCES: E. L. Crosby, W. P. Flanigan, G. J. Senner, E. H. Taze.

Massachusetts

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CAHN, I. M., Engr., Anderson-Nichols & Co., Boston. REFERENCES: W. G. Martin, D. W. Noble, M. G. Rolland*, F. C. William.

DARCY, F. P., Sales Engr., The National Radiator Co., Boston. REFERENCES: C. M. Baumgardner, W. G. Burbo, J. A. Ivester, H. F. White.

SYMMES, PARKER, Mech. Engr., Cabot, Cabot & Forbes Engineering Co., Cambridge. REFERENCES: J. P. Hoar, M. I. Kishler, W. G. Martin, Jr., D. W. Noble.

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Michigan

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DIRKS, H. F., Bldg. Mech. Engr., Michigan Bell Telephone Co., Detroit. REFERENCES: E. F. Glanz, E. M. Harrigan, W. H. Old, T. C. Schwer.

FENSKE, E. F., Supt., The Donald Miller Co., Detroit. REFERENCES: E. F. Glanz, D. L. McConachie, J. H. Spitzley, K. J. Wagoner.

JEHU, R. W., Engr., Barton-Malow Co., Detroit. REFERENCES: H. M. Armstrong, R. H. Oberschulte, T. C. Schwer, C. W. Trambauer.

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STAVOE, O. B., Mgr., Htg. Sales, Crane Co., Detroit. REFERENCES: W. G. Boales, R. L. Deppman, R. H. McGeorge, G. O. Sanders.

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Minnesota

△HOSS, R. D., Asst. to Field Training Supvsr., Minneapolis-Honeywell Regulator Co., Minneapolis. REFERENCES: J. E. Haines, J. D. Kroeker, J. S. Locke, E. F. Snyder, Jr.

△MCGEORGE, DEAN, Sales Engr., Johnson Service Co., Minneapolis. REFERENCES: C. B. Ashenfelter, C. T. Hastings, R. M. Jack, W. E. Ward.

NELSON, A. X., Owner, A. X. Nelson & Co., Minneapolis. REFERENCES: A. B. Algren, R. W. Evans, R. T. Haley, William Sturm.

Missouri

△BINGHAM, L. F., Design Engr., William L. Cassell, Mech. Engr., Kansas City. REFERENCES: W. L. Cassell, C. A. Flarsheim, G. F. Hellmer, Henry Nottberg, Jr.

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△LADEWIG, F. K., Dist. Mgr., The Trane Co., Kansas City. REFERENCES: D. M. Allen, H. E. Degler, A. S. Hurt, Jr., Henry Nottberg, Jr.

POLLINGER, LOUIS, Engr., Bank Building & Equipment Co., St. Louis. REFERENCES: C. J. Baker, J. J. Blackmore, E. T. Clucas, H. C. Sharp, Jr.

SANDMEYER, F. P., Mech. Engr., J. R. DeRigne & Associates, Kansas City. REFERENCES: B. F. Cook, J. R. DeRigne, C. R. Robbins*, A. L. Sneller.

Nebraska

Anders, J. M., Chief Engr., Air Conditioning Equipment Co., Omaha. References: R. N. Gates, C. A. Goth, K. E. Martin, G. H. Stoffer.

Griffith, J. D., Mech. Engr., John Latenser & Sons, Omaha. References: C. A. Goth, W. B. Howard, J. S. Latenser, K. E. Martin.

Mann, Sol, Engr., Corps of Engineers, District Office, Omaha. References: C. A. Carter, C. A. Goth, J. K. Hewett*, F. P. Manchester.

New Jersey

Hansen, A. H., Draftsman, L. J. Wing Mfg. Co., Linden. References: T. R. Peyrek, S. H. Smith, F. J. Swaney, H. S. Wheller, Jr.

Nichols, R. L., Appl. Engr., Worthington Corp., Harrison. References: N. A. Gardner*, F. A. MacConnell*, W. Schlapfer*, O. B. Wert*.

Shapiro, Sam, Secy., Adams Sheet Metal Co., Newark. References: R. L. Dobrin, H. C. Roden, Samuel Tepp, P. H. Werner.

†Van Woert, A. B., Test Engr., L. O. Koven and Brother, Inc., Jersey City. References: C. H. Flink, F. E. Hanson, N. E. Hill, F. J. Nunlist.

Woodworth, J. I., Field Sales Engr., Fedders-Quigan Corp., Trenton. References: T. L. Arnold, M. F. Blankin, J. P. Guerra, R. W. Morgan.

New Mexico

Ford, A. D., Sr., Prof. of Mech. Engrg., University of New Mexico, Albuquerque. References: C. E. Barnhart*, C. G. Davis*, C. T. Grace*, H. F. Munn.

New York

Aries, R. S., Cons. Engr., Brooklyn. References: Leslie Balassa*, R. M. Cziner*, George Mayurnik*, A. P. Sachs*.

△Bourquin, P. A., Engr., Wolff & Munier, Inc., New York. References: A. A. Giannini, P. B. Gordon, L. L. Munier, R. A. Wolff.

Gregory, D. H., Sales Engr., Minneapolis-Honeywell Regulator Co., Albany. References: L. V. Appleby, Lyford Brown, E. J. Mahoney, J. L. Ottenheimer.

Hazell, R. A., Br. Mgr., The National Radiator Co., Buffalo. References: J. H. Bryce, R. J. Doherty, F. E. Krell, D. M. Mosteller.

△Kane, W. G., Vice Pres., Lewis Associates Inc., Port Washington. References: H. J. Campbell, Jr., H. G. Junger, S. J. Levine, C. M. toeLaer.

Reizman, Marcel, Pres., M. Reizman, Inc., New York. References: F. F. Baumgartner*, E. K. Brown*, E. U. Markush, R. B. Taylor.

Valenstein, Richard, Heating Engr., Lakeland Air Conditioning, Peekskill. References: W. F. Bonwitt*, Morris Brenner*, Milton Leland*, Julian Rogoff*.

North Carolina

Macfie, T. E., Sales Engr., Johnson Service Co., Greensboro. References: R. F. Bean, J. E. Hart, Harry Hoffman, S. T. Oliver.

△Powell, H. W., Jr., Sales Engr., Chet Adams Co., Greensboro. References: C. Z. Adams, J. E. Hart, F. J. Reed, G. B. Rottman.

Ohio

△Christman, J. H., Repr., The Thermal Products Co., Akron. References: J. L. Frisse, B. D. Lind, W. M. Rogers, S. J. Stroud.

Deady, F. W., Sales Engr., Bryant Heater Div., Affiliated Gas Equipment, Inc., Cleveland. References: J. V. Crawford, K. T. Davis, M. C. Eck, H. W. Heisterkamp.

Jeffery, R. W., Eastern Mgr., Fostoria Pressed Steel Corp., Fostoria. References: I. J. Barber*, Herbert Fox, W. F. Little*, C. A. Stone.

†Johnson, P. B., Ind. Engr., North American Aircraft, Columbus. References: H. M. Curl, D. S. Ralph, W. A. Schoonover, J. D. Slemmons.

Krohm, J. F., Sales Mgr., Minneapolis-Honeywell Regulator Co., Cleveland. References: H. R. Canoyer, W. R. Moore, L. S. Oswald, S. J. Stroud.

†Williams, E. H., Chief Engr., The Hausman Steel Co., Toledo. References: F. A. Edgington, J. F. Guest, C. F. Hoffman, F. C. Richardson, Jr.

Oklahoma

△Dollmeyer, C. H., Mech. Engr., Collins & Gould, Cons. Engrs., Tulsa. References: W. J. Collins, Jr., G. T. Gould*, J. E. Tumilty, R. W. Winget.

MacKenzie, R. S., Cons. Engr., Oklahoma City. References: J. H. Carnahan, W. J. Collins, Jr., W. G. Parr, H. S. Shafer.

Oregon

△Kortum, H. A., Designer, J. Donald Kroeker & Assocs., Cons. Engrs., Portland. References: R. C. Chewning, E. R. Hoerner, E. E. Kelly, J. D. Kroeker.

△Maxwell, W. D., Associate, J. Donald Kroeker and Assocs., Cons. Engrs., Portland. References: R. C. Chewning, E. E. Kelly, J. D. Kroeker, R. E. Selberg.

Pennsylvania

Meyers, E. W., Jr., Pres., Trion, Inc., McKees Rocks. References: E. C. Hack, G. F. Landgraf, C. H. Schneider, C. S. Stephens.

†Searle, W. J., Jr., Designer, Carlos A. Mosquera, Philadelphia. References: L. M. Church, E. H. Dafter, P. F. Hunger, G. E. Klapper.

Tennessee

Alexander, K. S., Sales Engr., Johnson Service Co., Knoxville. References: J. R. Potter, T. D. Reiley, W. P. West, K. A. Wright.

Shy, D. M., Pres., D. M. Shy, Inc., Memphis. References: Beverly Buckingham*, R. P. Colmer, T. T. Hughes*, M. J. Licterman*.

Texas

△Downs, Fred, Vice Pres., Dallas Plumbing Co., Dallas. References: J. V. Edmondson, R. W. Hanson, B. V. Henegar, V. C. Kneese.

Price, H. S., Chief Mech. Engr., Reg. F. Taylor, Cons. Engr., Houston. References: C. L. Fleming, D. M. Mills, A. J. Natkin, R. F. Taylor.

Watt, J. R., Assoc. Prof. Mech. Engrg., University of Texas, Austin. References: A. J. Hess, W. E. Long, B. E. Short*, I. W. Wilke.

Utah

△Stuewe, W. L., Br. Mgr., Minneapolis-Honeywell Regulator Co., Salt Lake City. References: B. E. Brazier, M. L. Gollaher, E. Y. Gritton, A. A. Maycock.

Vermont

Jennison, N. E., Pres.-Treas., Jennison Engineering, Inc., Burlington. References: J. W. Goodrich, L. N. Hunter, L. E. Seeley, B. E. Shaw.

Washington

△Kelly, W. F., Jr., Br. Mgr., Minneapolis-Honeywell Regulator Co., Spokane. References: R. C. Chewning, B. W. Farnes, J. D. Kroeker, J. S. Locke.

West Virginia

Davis, D. C., Distr. Mgr., The Trane Co., Clarksburg. References: C. W. Davis, R. P. Dickinson, Jr., R. G. Lubinsky, R. C. Tonry.

Wisconsin

△Peterson, J. E., Sales Engr., Westinghouse Electric Corp., Milwaukee. References: T. R. Christy, H. K. Forfar, J. E. Illingworth, L. C. Plaehn.

Volker, E. F., Trainee, The Trane Co., La Crosse. References: R. G. Lubinsky, A. C. Menke, M. R. Paulsen, F. E. Wittig.

Canada

Book, C. S., Ottawa Gen. Mgr., Insul-Glass Sales, Ltd., Ottawa, Ont. References: R. A. Bruce*, T. G. Fuller*, Jacob Klassen, G. S. Macivor*.

Dwyer, F. J., Sales Mgr., Blain Boiler Works, Ltd., Vancouver, B.C. References: J. M. Bird, H. C. Harrigan*, C. W. Leek, D. W. Thomson.

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62 Worth St.
New York 13, N. Y.

JOURNAL SECTION

GODFREY, A. W., Htg. & Vtg. Engr., Plumbing & Heating Contractors, Ltd., Stephenville, Newfoundland. REFERENCES: D. S. Abbott*, J. Bradley*, W. Cann*, R. S. Reed*.

†MITCHELL, G. J., Sales Engr., E. H. Price, Ltd., Vancouver, B.C. REFERENCES: Jack Bean*, D. M. Drake, A. L. Pike, D. W. Thomson.

SCOTT, D. S., Asst. Prof., University of British Columbia, Vancouver, B.C. REFERENCES: P. B. Ayres*, R. W. Hole, W. O. Richmond, L. W. Shemilt*.

Venezuela

FLEMING, B. W., In charge Air Cond. & Refrig. Dept., C. A. La Casa Electrica, Maracaibo. REFERENCES: J. W. Booker, Harold Moir*, K. A. H. Murray*, D. J. R. Vickery*.

Students

OREGON STATE COLLEGE, Corvallis, Ore. CERTIFIED BY: G. E. Thornburgh.

ANDERSON, P. I.
LARSON, V. R.
LESLIE, J. A.
LONG, E. B.
REILEY, R. L.
STARK, J. A.

PURDUE UNIVERSITY, W. Lafayette, Ind. CERTIFIED BY: Frederick B. Morse.

CHIPLIS, T. J.
COURTNEY, R. P.
GARGES, N. H.
HEIDENREICH, T. A.
HINKLE, G. L.
MCNEIL, R. W.
MOHR, C. D.
NELSON, N. R.
POLICK, C. E.
WHIPPO, W. F.

UNIVERSITY OF TORONTO, Toronto, Ont., Canada. CERTIFIED BY: F. G. Ewens.

DAVIES, R. M.
KARPINSKI, J. M.
NURSE, R. J.
PARSONAGE, D. B.
ROBINS, R. F.
STAPLETON, G.
STARK, W. C.
STEWART, W.
VINCE, J. P.

OBITUARIES

FRED W. POWERS
Skokie, Illinois

Fred W. Powers, 87, chairman of the board of directors, The Powers Regulator Co., Skokie, Ill., died October 14, 1954. He was a Life Member of THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, having joined the Society in 1911. He was also a Veteran Member of *The Chicago Athletic Association.*

Fred W. Powers
Skokie, Ill.

Born August 13, 1867, at La Crosse, Wis., Mr. Powers began his career there in his father's plumbing and heating business. Mr. Powers was president of The Powers Regulator Co. from 1928 to 1945, when he was elected chairman of the board. Like his father, who founded The Powers Regulator Co. in 1891, Mr. Powers, during his sixty years with the company, contributed much to the field of automatic temperature and humidity control.

Mr. Powers is survived by his widow, Ida T. Powers, a daughter, Mrs. Jessie P. Schultz, a son, David J., six grandchildren, and five great grandchildren. The Society's Officers and Council extend their sincere sympathy to his entire family.

ORAN W. OTT
San Marino, Calif.

Oran W. Ott, consulting engineer, died recently at his home in San Marino, Calif. Mr. Ott was buried in Chicago, where he was born on January 1, 1881.

A graduate of Cornell University, Mr. Ott served as mechanical engineer for Oregon Short Line Road and U. S. Smelting, Refining, and Mining Co., both of Salt Lake City. He was in private practice as a consulting engineer in Salt Lake City from 1912-1922, and then in Los Angeles for some 30 years.

Condolences were extended by the Society's Officers and Council to his widow and three daughters, Miss Nancy C. Ott of San Francisco, Mrs. W. I. McGowan and Miss Eliza V. Ott, both of San Marino.

THE AMERICAN SOCIETY

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(58 Chapters; 1 Special Branch; 8 Student Branches)

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● **ARKANSAS:** 1952. Hdqrs., Little Rock, Ark. Meets, Third Tuesday. PRESIDENT, R. E. Blaylock, 509 E. Markham St. SECRETARY, J. L. Brown, 212 Terminal Warehouse Bldg.

● **ATLANTA:** 1937. Hdqrs., Atlanta, Ga. Meets, Second Monday. PRESIDENT, J. M. Lazenby, 8 11th St., N.E. SECRETARY, F. W. Bull, 1205 Spring St., N. W.

● **BALTIMORE:** 1949. Hdqrs., Baltimore, Md. Meets, Third Wednesday. PRESIDENT, E. H. Taze, 33 E. 21st St. (18). SECRETARY, R. F. Weisman, 4650 Reisterstown Rd., (15).

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● **CENTRAL NEW YORK:** 1944. Hdqrs., Syracuse, N. Y. Meets, Fourth Wednesday. PRESIDENT, F. D. Putnam, 115 Pulsifer Dr., Auburn. SECRETARY, Merle Weninger, 230 Goodrich Ave. (5).

● **CENTRAL OHIO:** 1944. Hdqrs., Columbus, Ohio. Meets, Third Monday. PRESIDENT, J. A. Guy, 478 W. Fifth Ave. (1). SECRETARY, W. A. Schoonover, 2901 N. High St. (2).

● **CINCINNATI:** 1932. Hdqrs., Cincinnati, Ohio. Meets, First Tuesday. PRESIDENT, F. W. Wilson, 222-24 E. 14th St. SECRETARY, R. G. Anderson, 1758 Elmore St. (23).

● **CONNECTICUT:** 1940. Hdqrs., New Haven, Conn. Meets, Third Thursday. PRESIDENT, C. L. L'Hommedieu, 76 Blatchley Ave. SECRETARY, Walter Heywood, 14 Hartt Lane, Newington.

● **DELTA:** 1939. Hdqrs., New Orleans, La. Meets, Third Tuesday. PRESIDENT, C. V. Bankston, 2927 Jackson Ave. (25). SECRETARY, W. B. Martin, Jr., 2014 Rendon St. (15).

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● **INDIANA:** 1943. Hdqrs., Indianapolis, Ind. Meets, Fourth Tuesday. PRESIDENT, P. O. Patterson, 2701 Roosevelt Ave. SECRETARY, A. O. Roche, Jr., 3950 Broadway (5).

● **INLAND EMPIRE:** 1950. Hdqrs., Spokane, Wash. Meets, First Monday. PRESIDENT, H. A. Bickel, E. 7 Riverside Ave. SECRETARY, Max Tonn, S. 4021 Latawah St.

● **IOWA:** 1940. Hdqrs., Des Moines, Ia. Meets, Second Tuesday. PRESIDENT, W. E. Nanes, 220 Davidson Bldg. SECRETARY, D. E. Schroeder, 2717 Cambridge.

● **KANSAS:** 1951. Hdqrs., Wichita, Kan. Meets, Tuesday after First Monday. PRESIDENT, Charles Yoe, P.O. Box 2239. SECRETARY, T. L. Roberts, 2008 S. Parkwood Lane.

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● **MANITOBA:** 1935. Hdqrs., Winnipeg, Man., Canada. Meets, Fourth Thursday. PRESIDENT, G. T. Christie, Midland & Notre Dame. SECRETARY, A. J. McIntyre, 935 Garwood Ave.

● **MASSACHUSETTS:** 1912. Hdqrs., Boston, Mass Meets, Third Tuesday PRESIDENT, G. W. Sprague, 108 Cummington St. SECRETARY, W. G. Burbo, 137 Newbury St. (16).

● **MEMPHIS:** 1944. Hdqrs., Memphis, Tenn. Meets, Third Monday. PRESIDENT, A. W. Shelby, 972 Union Ave. SECRETARY, A. T. Bevil, 1638 Union Ave. (4).

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● **MINNESOTA:** 1918. Hdqrs., Minneapolis, Minn. Meets, First Monday. PRESIDENT, J. A. Craig, 814 South Ninth St. (4). SECRETARY, E. T. Erickson, 500 Baker Arcade (2).

● **MISSISSIPPI:** 1953. Hdqrs., Jackson, Miss. PRESIDENT, I. E. Rowe, 120 Georgia St. SECRETARY, M. E. Price, 144 S. Congress St.

● **MONTREAL:** 1936. Hdqrs., Montreal, Que., Canada. Meets, Third Monday. PRESIDENT, D. L. Lindsay, 4350 Sherbrooke St. (6). SECRETARY, S. R. Plamondon, 2267 Melrose Ave. (14).

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● **NEW MEXICO:** 1954. Hdqrs. Albuquerque, N.M. PRESIDENT, J. H. Van Alsburg, 1330 Cerro Gordo, Santa Fe. SECRETARY, J. K. James, 4462 Avenida del Sol.

● **NEW YORK:** 1911. Hdqrs., New York, N. Y. Meets, Third Monday. PRESIDENT, R. L. Stinard, 51 E. 42nd St. (17). SECRETARY, Carl H. Flink, 62 Worth St. (13).

● **NORTH JERSEY:** 1952. Hdqrs., Newark, N. J. Meets, Second Tuesday. PRESIDENT, H. M. Patrick, 20 Olcott Ave., Bernardsville. SECRETARY, W. C. Kruse, Jr., 183 N. 13th St. (7).

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● **ONTARIO:** 1922. Hdqrs., Toronto, Ont., Canada. Meets, First Monday. PRESIDENT, M. C. Bailey, 1139 Bay St. SECRETARY, H. R. Roth, 57 Bloor St., W.

● **OREGON:** 1939. Hdqrs., Portland, Ore. Meets, Thursday after First Tuesday. PRESIDENT, E. E. Kelly, 4504 S.W. Corbett Ave. (1). SECRETARY, K. N. Flocke, 3027 N.E. 31st Ave. (12).

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● **PACIFIC NORTHWEST:** 1928. Hdqrs., Seattle, Wash. Meets, Second Tuesday. PRESIDENT, T. C. Caskey, 11642—26th Ave., So. (88). SECRETARY, E. W. Triol, 407 Medical Arts Bldg. (1).

● **PHILADELPHIA:** 1916. Hdqrs., Philadelphia, Pa. Meets, Second Thursday. PRESIDENT, L. M. Church, 12 So. 12th St. (7). SECRETARY, C. J. Forve, Parkwood Manor, Apt. B-202, State Rd. & Penarth Ave., Upper Darby.

● **PITTSBURGH:** 1919. Hdqrs., Pittsburgh, Pa. Meets, Third Monday. PRESIDENT, E. C. Hach, 221 Broadmoor Ave. (34). SECRETARY, E. H. Riesmeyer, Jr., 231-33 Water St. (22).

● **ROCKY MOUNTAIN:** 1944. Hdqrs., Denver, Colo. Meets, First Wednesday. PRESIDENT, V. F. Vallero, 620 12th St. SECRETARY, Duane Pearsall, 1600 W. 13th Ave.

● **SACRAMENTO VALLEY:** 1952. Hdqrs., Sacramento, Calif. Meets, First Wednesday. PRESIDENT, J. E. Marshall, 441 Pico Way. SECRETARY, V. W. Thornburg, 2470 27th Ave.

● **ST. LOUIS:** 1918. Hdqrs., St. Louis, Mo. Meets, Second Tuesday. PRESIDENT, G. H. Bemarkt, St. Clair Dr., R.R. 1, Caseyville, Ill. SECRETARY, W. P. Norris, 1118 Fullerton Bldg.

● **SHREVEPORT:** 1948. Hdqrs., Shreveport, La. Meets, Third Thursday. PRESIDENT, J. S. Malahy, Jr., 1839 Line Ave. SECRETARY, H. E. Scott, 2502 Woodford St.

● **SOUTH CAROLINA:** 1954. Hdqrs., Columbia, S. C. PRESIDENT, R. F. Donovan, P.O. Box 3053. SECRETARY, J. E. McMurray, 1639 Blanding St.

● **SOUTH TEXAS:** 1938. Hdqrs., Houston, Tex. Meets, Third Friday. PRESIDENT, J. W. Holland, 245 Esperson Bldg. (2). SECRETARY, J. C. Lewis, Box 8188.

● **SOUTHERN CALIFORNIA:** 1930. Hdqrs., Los Angeles, Calif. Meets, First Tuesday. PRESIDENT, C. D. Walz, 3600 San Pasqual St., Pasadena (10). SECRETARY, H. F. Ulovec, 3886 Olympiad Dr. (43).

● **SOUTHERN PIEDMONT:** 1952. Hdqrs., Charlotte, N.C. PRESIDENT, R. S. Fullerton, P.O. Box 3697. SECRETARY, J. R. Clark, P.O. Box 1755.

● **SOUTHWEST TEXAS:** 1946. Hdqrs., San Antonio, Tex. Meets, Third Tuesday. PRESIDENT, L. H. Hornor, Jr., 816 Insurance Bldg. SECRETARY, Boone Crisp, P.O. Box 9065, (4).

● **TOLEDO:** 1954. Hdqrs., Toledo, Ohio. PRESIDENT, F. C. Richardson, Jr., 1938 Shenandoah Rd. (7). SECRETARY, J. F. Guest, 1815 N. 13th St. (2).

● **UTAH:** 1944. Hdqrs., Salt Lake City, Utah. Meets, Third Thursday. PRESIDENT, A. A. Maycock, P.O. Box 36 (10). SECRETARY, W. L. Stuewe, 1472 S. State St. (4).

● **VIRGINIA:** 1946. Hdqrs., Norfolk, Va. Meets, Third Wednesday. PRESIDENT, H. E. Marquart, 111 W. Main St. SECRETARY, R. L. Burton, Jr., 1913 Lafayette Blvd.

● **WASHINGTON, D. C.:** 1935. Hdqrs., Washington, D. C. Meets, Second Wednesday. PRESIDENT, G. C. F. Asker, 1109 W. Broad St., Falls Church, Va. SECRETARY, C. P. Humke, 5905 Berwyn Rd., Rt. 1, Box 89, College Park, Md.

● **WEST TEXAS:** 1953. Hdqrs., Lubbock, Tex. PRESIDENT, L. C. McKay, 210 Sanford Bldg. SECRETARY, J. C. Wharton, Box 1240.

● **WESTERN MICHIGAN:** 1931. Hdqrs., Grand Rapids, Mich. Meets, Second Monday. PRESIDENT, F. W. Brundage, 512 N. Park St., Kalamazoo (11). SECRETARY, F. L. Murray, 482 W. Michigan Ave., Battle Creek.

● **WESTERN NEW YORK:** 1919. Hdqrs., Buffalo, N. Y. Meets, Second Monday. PRESIDENT, Q. P. Thompson, 260 Richmond Ave. (22). SECRETARY, G. E. Kuhn, 475 Woodland Dr., Kenmore (23).

● **WISCONSIN:** 1922. Hdqrs., Milwaukee, Wis. Meets, Third Monday. PRESIDENT, L. C. Plaehn, 914 N. Broadway (2). SECRETARY, H. W. Alyea, 507 E. Michigan St. (2).

SPECIAL BRANCH

● **SWITZERLAND:** 1952. Hdqrs., Zurich. PRESIDENT: Walter Sennhauser, Sulzer Bros., Ltd., Winterthur. SECRETARY, Walter Hausler, Erbstrasse 2, Kusnacht, Zurich.

STUDENT BRANCHES

● **NORTH CAROLINA STATE COLLEGE:** 1948. Hdqrs., Raleigh, N. C. PRESIDENT, Norman Falbaum, Box 4668, State College Station. SECRETARY, J. L. Flowers, Apt. 33-E, Vetville.

● **OKLAHOMA A. & M. COLLEGE:** 1950. Hdqrs., Stillwater, Okla. PRESIDENT, C. E. Durrett, 1215 College. SECRETARY, R. M. Jauch, 308½ W. Maple.

● **OREGON STATE COLLEGE:** 1949. Hdqrs., Corvallis, Ore. Meets, First Wednesday after First Tuesday. PRESIDENT, R. E. Bulletset, 252 Kings Rd. SECRETARY, I. P. Parkhurst, 1354 Harrison.

● **PURDUE UNIVERSITY:** 1948. Hdqrs., W. Lafayette, Ind. CHAIRMAN, E. B. Katz, 415 State St. SECRETARY, R. A. Chambers, 248 Littleton.

● **TEXAS A. & M. COLLEGE:** 1946. Hdqrs., College Station, Tex. Meets, Second and Fourth Tuesday. PRESIDENT, D. F. Carroll, Box 6264. SECRETARY, C. W. Farrar, Jr., Rt. 1, Box 339, Bryan.

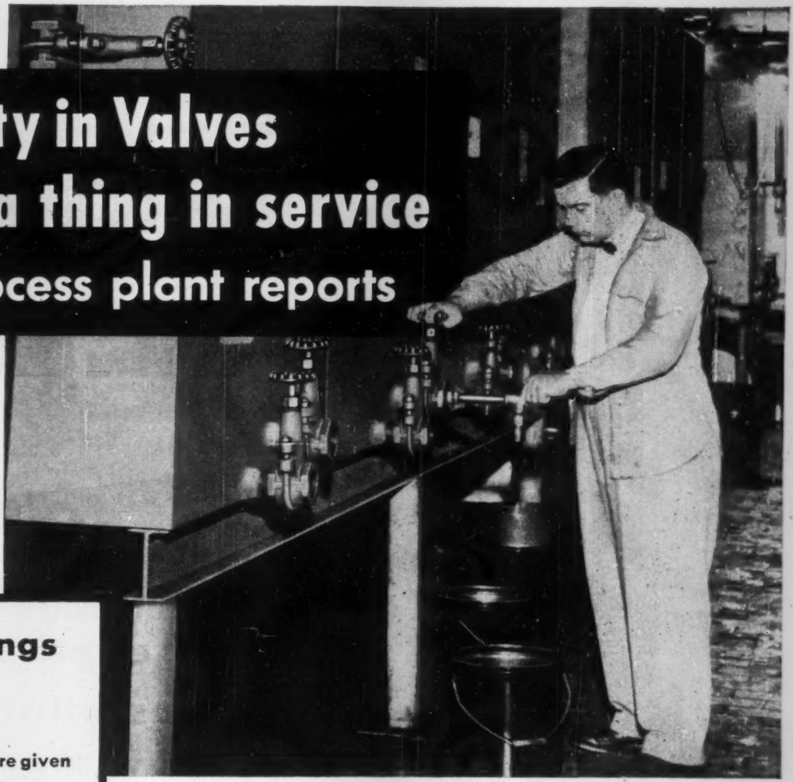
● **UNIVERSITY OF DETROIT:** 1949. Hdqrs., Detroit, Mich. Meets, First Tuesday. PRESIDENT, J. R. Cairns, 4001 Florence, (21). SECRETARY, W. E. Zimmerman, 15359 Lauder (27).

● **UNIVERSITY OF TEXAS:** 1949. Hdqrs., Austin, Tex. Meets, First and Third Tuesday.

● **UNIVERSITY OF TORONTO:** 1951. Hdqrs., Toronto, Ont. CHAIRMAN, Alexander Tudor, 75 South Dr. SECRETARY, T. M. Devine, More House, St. Michaels College.

Similarity in Valves doesn't mean a thing in service

... Chicago process plant reports



The Installation

At Hysan Products Co., Chicago manufacturer of liquid waxes, pine oil and coal tar disinfectants, liquid soaps, insecticides and various chemical specialties—where Crane clamp gate valves have been installed on all process and storage piping.

Valve Service Ratings

SUITABILITY: Performance-proved

FEATURES: Tight seating

MAINTENANCE COST: Only routine care given

SERVICE LIFE: Many times former valves—still like new

OPERATING RESULTS: Costly loss and trouble stopped

AVAILABILITY: Crane Catalog item—No. 488

The Valve

Crane clamp gates are of rugged design, with seating surfaces machined to close tolerances. That's why they provide long-lasting, tight closure, even where operation is frequent and fluids are hard to hold. Many patterns to choose from in these compact valves—all iron or brass-trimmed. Consult your Crane Catalog or your Crane Representative.

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The Case History

Longest service given by similar type valves formerly used was from 2 to 6 months. They failed to hold tight at seats and disc under daily operation of 3 to 12 cycles. Valve maintenance and replacements were excessively costly—as were down-time losses. Leaky valves on tank lines forced repeated transfer of storage stock. Up to 3 men were needed to make valve repairs.

Only when the plant switched to Crane No. 488 clamp gate valves was the trouble stopped. Installed more than a year ago, the valves show no sign of wear or leakage. Only an occasional pull-up on the packing nut is needed—and only one man for all piping maintenance.

What's the answer? Better quality valves, obviously—the only way to assure better service and lower ultimate cost.

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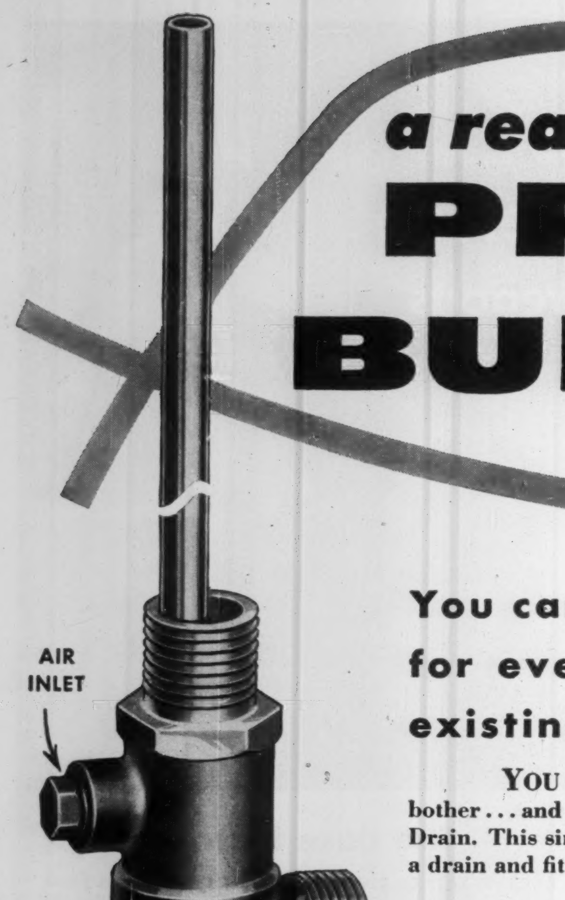
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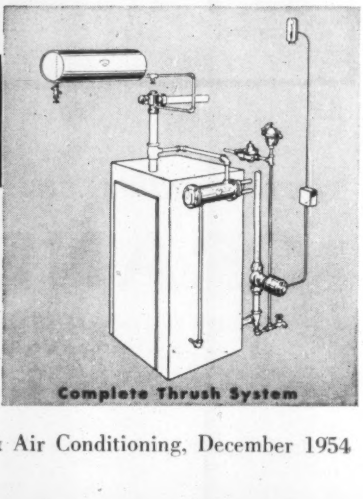
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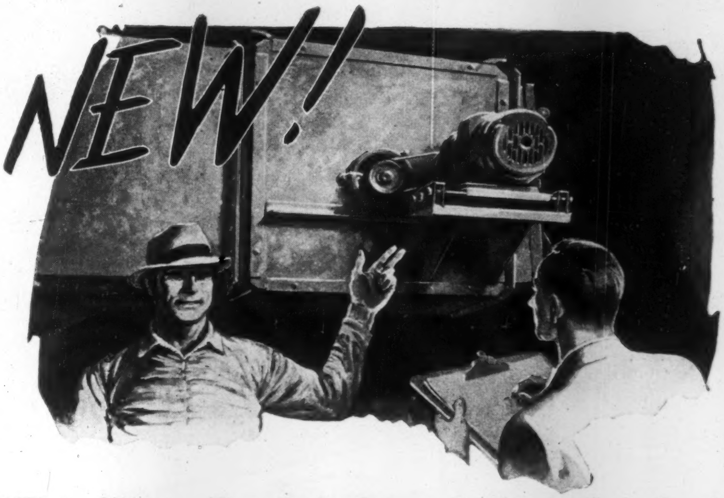

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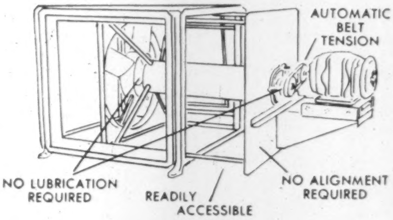
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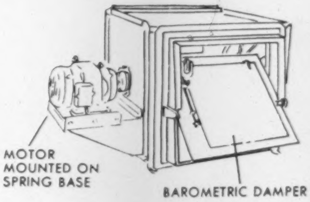
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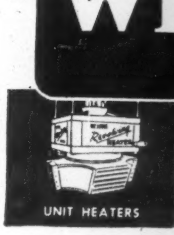
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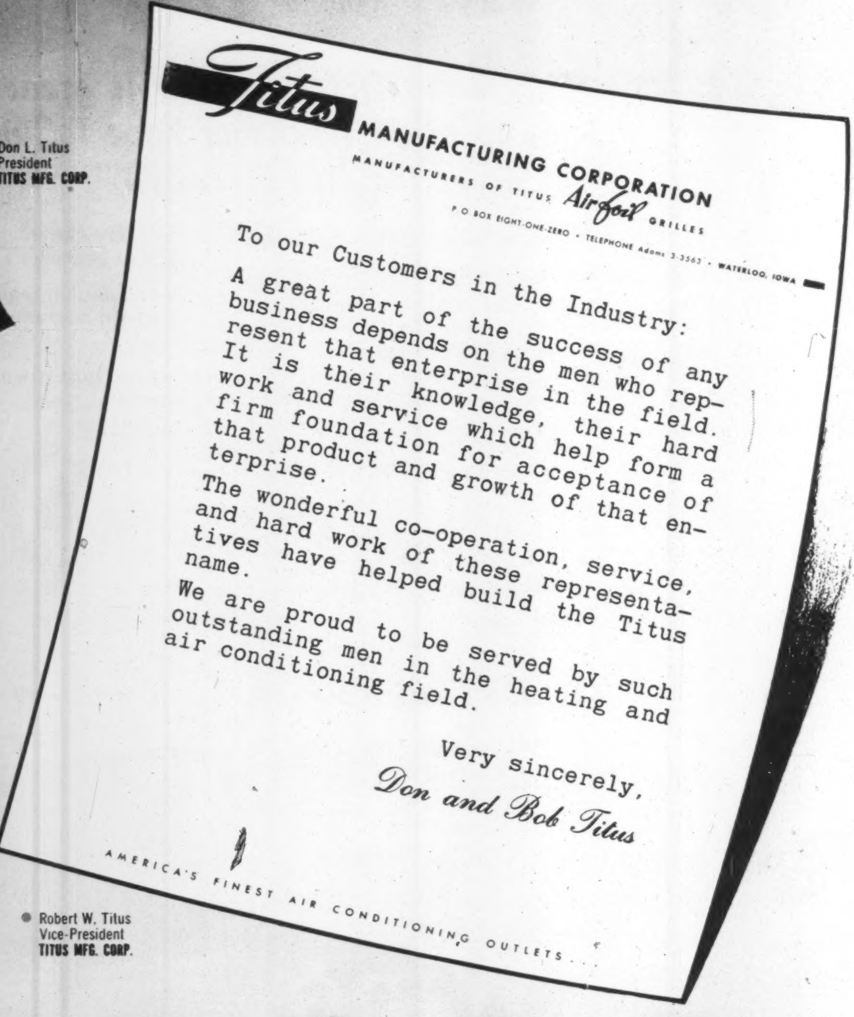
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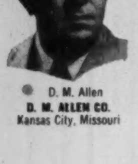
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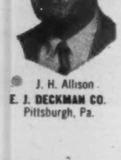
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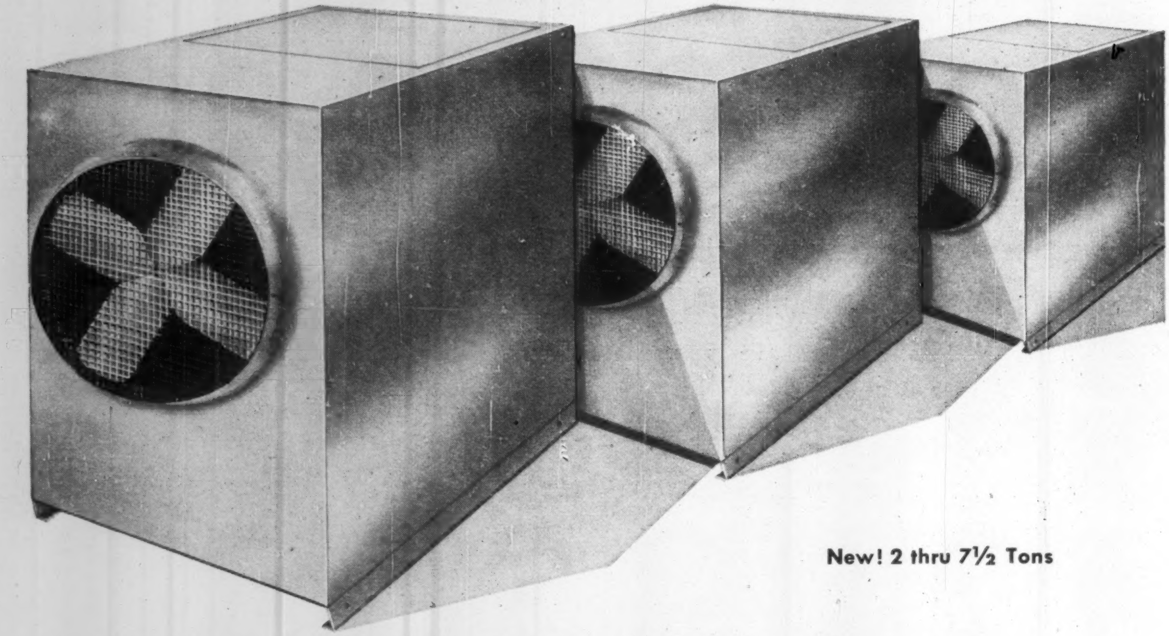

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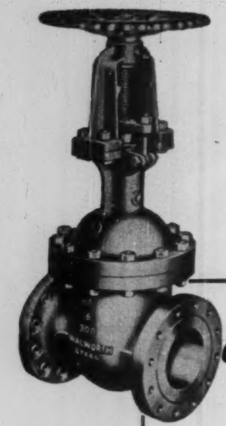

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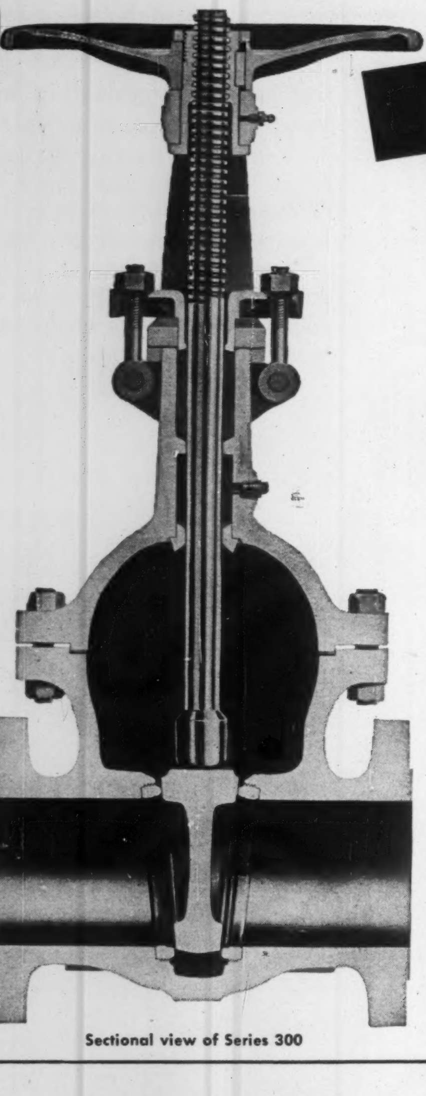

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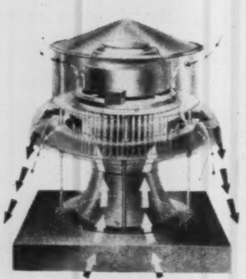
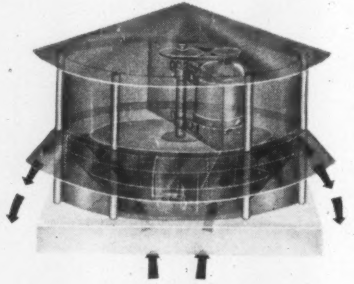
Gallaher research indicates that unless scroll effect is present, efficient against even normal static pressures are impossible and that in actual tests where ratings are predicated, instead of being physically tested, errors may run 50% or more.

So why not be sure. Gallaher units are certified to give peak performance.



Direct drive (far left) develops up to 4" S.P. 150 to 11,000 CFM.



Belt Drive develops to 4" S.P. 1,000 to 65,000 CFM.

For full information write

The GALLAHER Company

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Talk about silent operation and smooth performance! SEALMASTER engineers have done it again! This *new* Rubber Mounted, Zone Hardened Ball Bearing Unit has all the features the air-conditioning industry has been looking for. Designed to reduce noise and vibration a Zone Hardened SEALMASTER Ball Bearing Unit is mounted in a synthetic, oil-resistant rubber ring which fits snugly into a pressed steel housing. (Cartridge units available for insertion in special and built-in housings). The result is a bearing unit which when built into your product affords you a distinct competitive advantage and a plus feature for your sales story.

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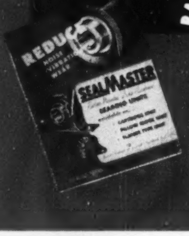
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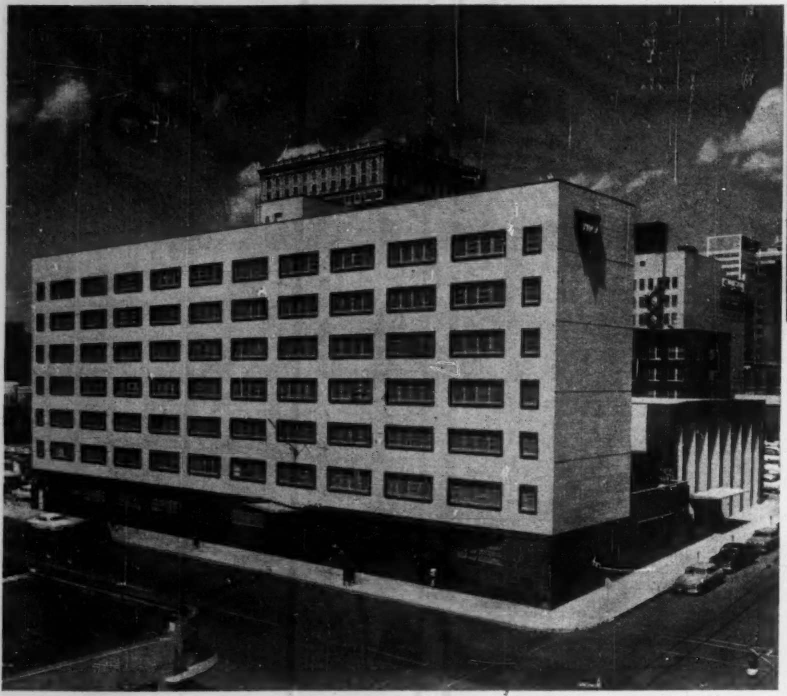
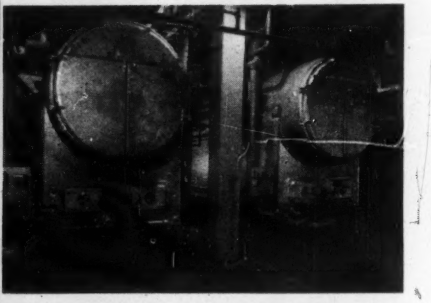




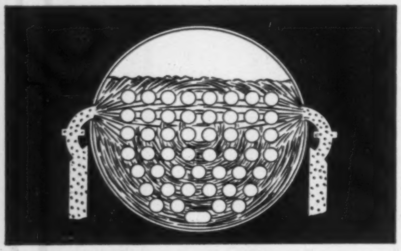
These two Pacific Boilers heat the building and temper water for the swimming pool at the Tulsa YMCA. Fuel consumption is lower because *Jet-action* Circulation maximizes heat transfer.

Tulsa's beautiful new YMCA is one of the most modern in the U.S.A. Architect–Leon B. Senter; Builder–Grimshaw Construction Co.; Mechanical Contractor–Watt Plumbing, Heating & Air Conditioning Co.; all of Tulsa, Okla.

New YMCA gets more heat for the money . . . uses Pacific Boilers with *Jet-action* Circulation!

The new seven-story YMCA in Tulsa, Okla., provides many comforts of a luxury hotel. Yet, in true YMCA tradition, operating costs are kept low to make living and playing at the Y inexpensive. A major factor in keeping costs down are the Pacific Boilers that heat the building and temper water for the swimming pool.

Unlike ordinary boilers, Pacific Boilers have *Jet-action* Circulation to sweep away—and keep away—air and steam bubbles that cling to heating tubes and eat up fuel.



Steam and hot water are propelled at high speed across the heating tubes by Pacific's exclusive jet-like circulating connections. The tumbling turbulence of this *Jet-action* Circulation scrubs heating tubes clean . . . away go the insulating bubbles that impair heat transfer! Up goes efficiency! Down goes fuel consumption! And when temperature change is desired, the response is practically immediate!

Your customers will welcome the extra efficiency of *Jet-action* Circulation . . . and the lower fuel bills. For complete satisfaction, specify Pacific Boilers. They come in all sizes, using all fuels, for any type building, and are easy to install. Your local Pacific representative will gladly supply catalogs and engineering data. Call him today!

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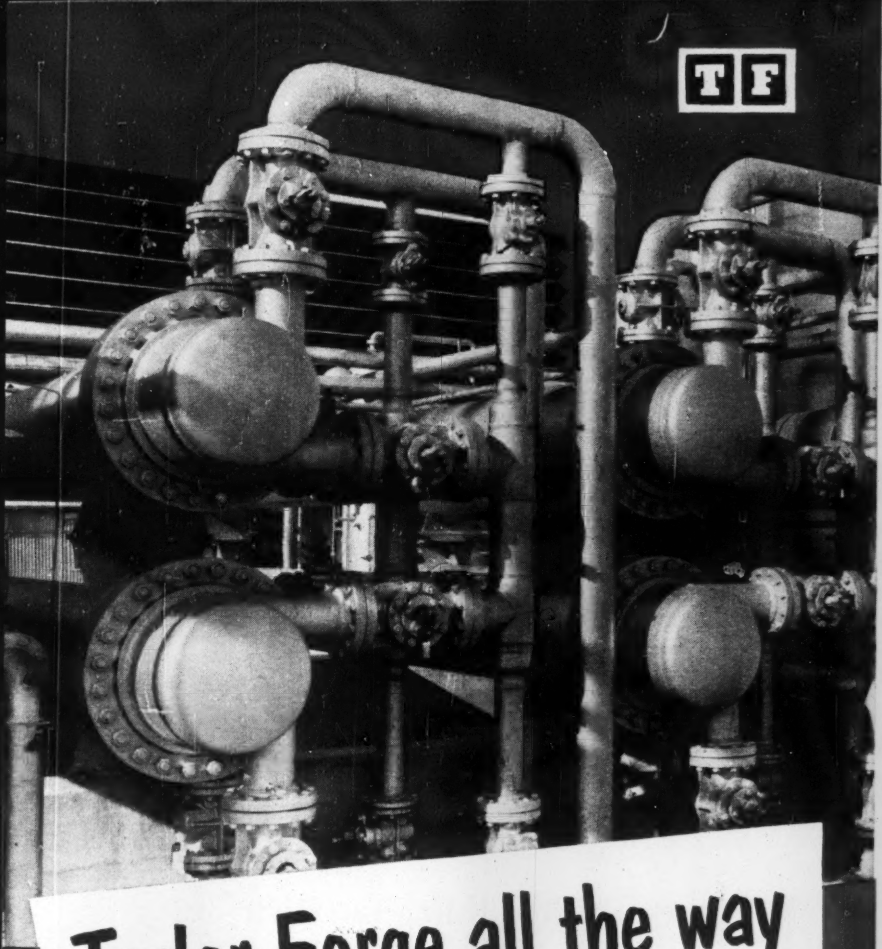

Taylor Forge all the way

Throughout the power and process industries you will see hundreds of model installations like this where someone who wanted to be sure has specified Taylor Forge all the way through... WeldELLS,® flanges, welding necks, nozzles.

Whatever your needs—simple or complex—it will pay you to *use* all the way through, the products that have *led* all the way through.

See your Taylor Forge Distributor for up-to-the-minute facts.

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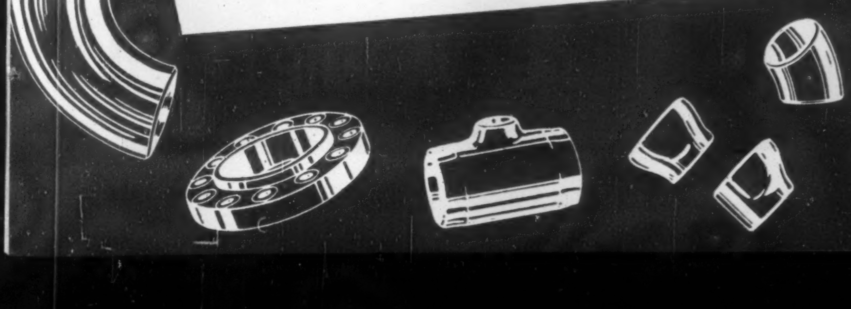
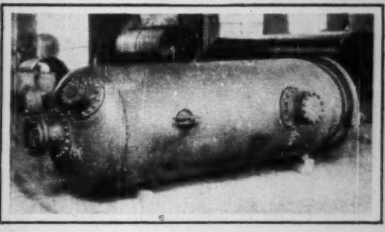




A New Development that's 37 Years Old

When you cut a hole in the shell of a pressure vessel you of course weaken it. But, how much?...or, to put it another way, how much reinforcement is necessary to make the shell surrounding an opening as strong as any other part of the shell?

In the old days of low pressure and over-sizing that hadn't been much of a problem. But when pressures began to climb fast (about 1915) it became a tough one.

Taylor Forge had already begun to relish problems like this: had pioneered the forged steel flange; was playing a major part in the development of flange and piping standards. So it isn't at all surprising that Taylor Forge again came forward with the solution — the first seamless forged steel pressure vessel nozzles.

The research and testing that Taylor Forge put into designed pressure vessel outlets dates back to the riveted, sweep nozzles that are still giving safe, satisfactory service. But as riveting gave ground to welding, still more critical analyses were made to determine the exact requirements of nozzles designed for welding.

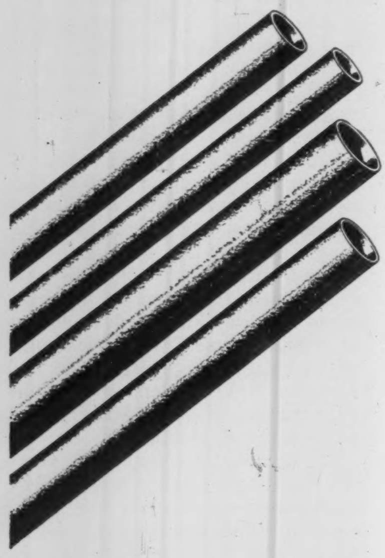
These many years of tests and studies were fully summed up in a paper entitled "Effects of Openings in Pressure Vessels" which was presented by the late J. Hall Taylor and Professor E. O. Waters at the June 1933 meeting of the ASME. It is still authoritative in this field.

Yes, a new idea that is 37 years old! So thoroughgoing was its first development—so critical the steps taken to maintain its leadership—that today Taylor Forge Seamless Nozzles and Welding Necks are the standards of the entire pressure vessel and piping industry.

An episode in the story of Taylor Forge leadership in designed piping

ANOTHER TRUCKLOAD OF STEEL PIPE...

Special Delivery!



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Your Republic Pipe Distributor is right on his toes . . . ready to serve you at a moment's notice. And when you rely on his well-stocked warehouse to fill orders, you actually have all the advantages of your own stockroom —without the disadvantages.

You have no worries about inventory losses. No insurance or handling costs. And best of all—no need for large capital investments.

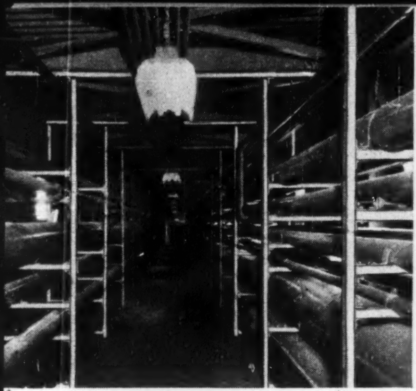
Your Republic Pipe Distributor always keeps on hand a full line of quality pipe and piping supplies—everything needed for complete plumbing, heating, refrigeration, air conditioning, process and industrial piping, or other piping jobs.

It will pay you to send for your copy of his stock list today. Keep it handy at all times. Remember, his services are as near as your telephone.

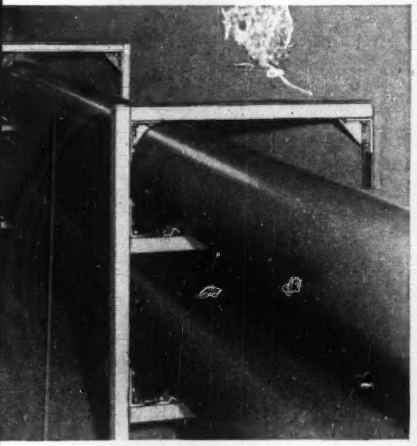
- Easy to bend, thread, and close coil
- Easy to weld by all methods
- Uniformly ductile
- Uniformly strong
- Uniformly clean and scale-free
- Uniform wall thickness, diameter, concentricity
- Economical uniform lengths, extra long lengths

REPUBLIC STEEL

REPUBLIC STEEL PIPE



In this tunnel between two buildings, pipes of all sizes and types are supported on strong UNISTRUT framing. Exact slope and pitch are easily attained because of the adjustability of this system.



UNISTRUT framing used to rack heavy water and sludge lines at large sewage treatment plant. Note convenient UNISTRUT concrete inserts.

Frames of UNISTRUT® channel mean better pipe racking for less

Note how simply UNISTRUT framing is assembled—all you do is cut the channel to length, slip in the spring-held clamping nut and tighten with a wrench. No welding, drilling or riveting is needed with this fast pipe-racking method!

To make your work even easier, UNISTRUT framing brings you a complete *package* system—everything necessary for racks to hold heavy water lines or light conduit. Clamps, concrete inserts, hangers, rollers—all these and other accessories are stock parts of the UNISTRUT system.

Getting the exact slope or pitch is only a matter of adjustment with UNISTRUT framing. And you can stop worrying about future alterations or changes. For this unique system unbolts as simply as it goes together. Permits changes or additions at any time. You can use it again and again and never lose your original investment.

Why not take advantage of this system on your next job? You'll find it reduces engineering detailing, installation time and gives you a better job for less money. Distributors and warehouse stocks available in all principal cities. In Canada, Northern Electric Company.

MR. STRUT SAYS:

See the new UNISTRUT film "The Sky's The Limit" and the UNISTRUT demonstrator car with all parts and uses of UNISTRUT framing.

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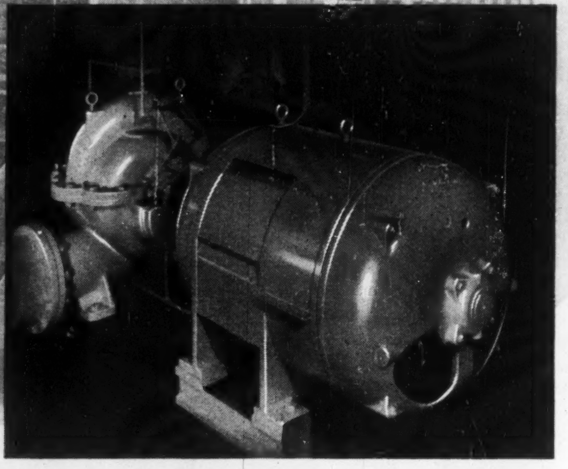
Below: The Gateway Center — imposing and beautiful indication of Pittsburgh's extensive "face lifting." The air conditioning system in these buildings sets new records for size and advanced features. Mechanical contractor: Kirby Saunders, Inc. Consulting Engineers: Meyer Strong & Jones. Architects: Irwin Clavan, and Eggers and Higgins. Builders: Starret Bros. & Eken, Inc. Owners and Operators are the Equitable Life Assurance Society of the United States.

"Largest commercial
air conditioning
system" uses...



ELLIOTT CROCKER-WHEELER MOTORS

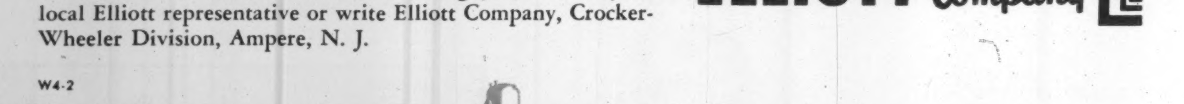
PITTSBURGH'S NEW GATEWAY CENTER includes three fine modern office buildings of 20 and 24 stories, in which are 6013 individual room-cooling units, making what is reputed to be the largest commercial system of air conditioning in the world. Air, driven by 24 fans, high and low pressure, circulates at the rate of 750,000 cfm. Water piping required totals 72 miles, carrying water at 7500 gpm.

In this large installation many Elliott Crocker-Wheeler motors drive intake fans, exhaust fans, cooling water pumps and refrigeration pumps. For the details which indicate why these motors were selected for this outstanding job, contact your local Elliott representative or write Elliott Company, Crocker-Wheeler Division, Ampere, N. J.

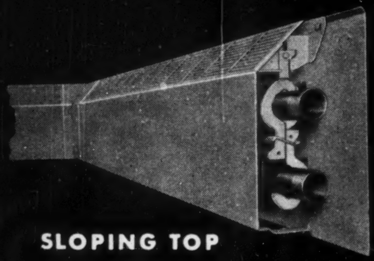
Above: Close-up of one of the numerous Elliott C-W motors that handle important drives in the huge air conditioning system. This is one of three 200-hp, 1170-rpm drip-proof induction motors that drive the 4600-gpm, 125 ft. head condenser-water pumps. Other Elliott motors from 7½ hp up are driving the many pumps and fans at the Gateway Center.

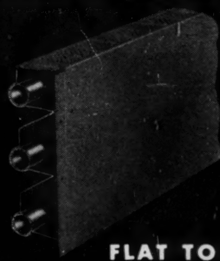
ELLIOTT Company

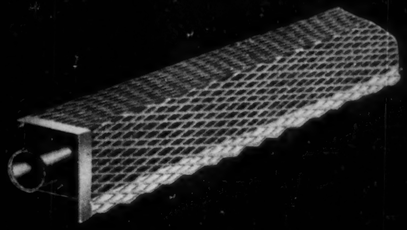
W4-2


TURBINE-GENERATORS
TURBINES
MOTORS
GENERATORS
DEAERATING HEATERS
EJECTORS
CONDENSERS
COMPRESSORS
TURBOCHARGERS
TUBE CLEANERS
STRAINERS

FIN-VECTOR

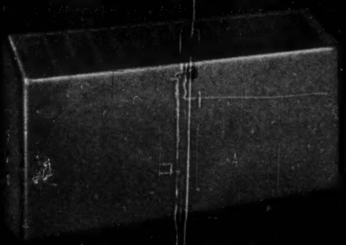

SLOPING TOP

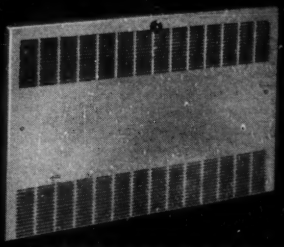

FLAT TOP


EXPANDED

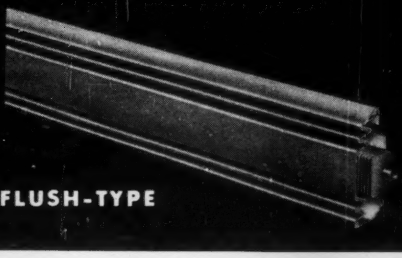
CONVECTORS

FLOOR CABINET


WALL CABINET


RECESSED CABINET

BASEBOARD


SEMI-RECESSED AND FLUSH-TYPE

Here's *everything* you need in radiation ...from the *complete* Dunham line

Getting your hands on the *particular kind* of radiation you need is fast and simple . . . when you depend on Dunham. The reason, of course, is that Dunham has as complete a line of quality radiation as you can find . . . *anywhere!*

So why bother to shop around getting one *type* of radiation here . . . another *type* there? Why not, instead, depend on Dunham for everything you need in radiation from flush-type or semi-recessed baseboard; flat top, sloping top or expanded metal along-the-wall Fin-Vector®; to sturdy, attractive high-capacity convectors.

"Let Dunham do it" and you not only get everything you need in a hurry, you also place full responsibility for your job's performance on one set of shoulders—Dunham's. For complete information about this complete radiation line, clip and mail the coupon.

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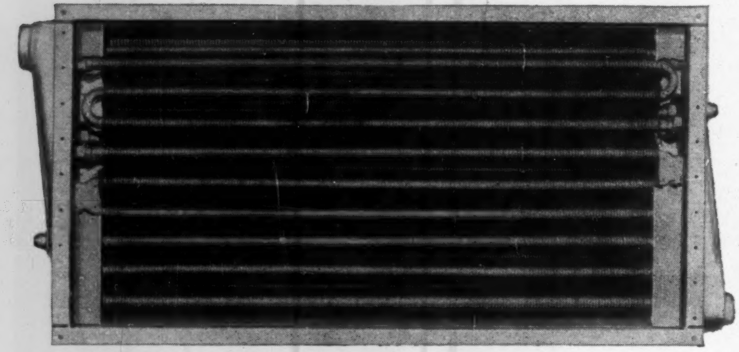

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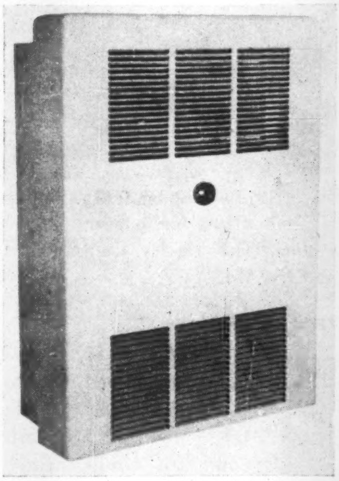
EQUIPMENT DEVELOPMENTS . . .

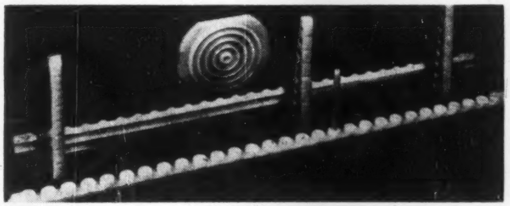
For reviews of Recent Trade Literature see Page 196.

Packaged Heating and Cooling System



A new hot and chilled water heating and cooling system is designed to provide year round air conditioning at low price. The "Dual-Vector" is as easily installed in existing wet-heat structures as it is in new buildings, the manufacturer reports. Forced hot water circulated through the unit furnishes heat in winter and chilled water circulation provides air conditioning in summer. A unit fan control gives individual room temperature and humidity capacities, which can be operated either thermostatically or by manual settings, the company continues. Only rooms in use need be heated or cooled. The units are used in series and are designed for use with one or two pipe systems. Union Asbestos & Rubber Co., 332 S. Michigan Ave., Chicago, Ill.

Nylon Insulation for Air Cleaner



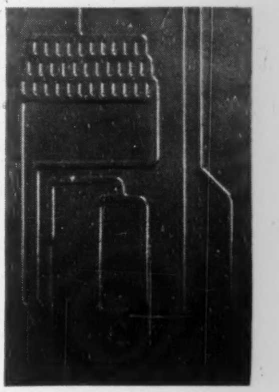
Molded nylon, a material not generally employed in high voltage insulation, is used in an electrostatic unit which functions at a 12,000 volt potential. Sixty parts, molded of nylon resin in six different designs, are used in each unit of the electrostatic air filter. The resulting unit is light in weight and resistant to breakage, the company says. American Air Filter Co., Inc., 373 Central Ave., Louisville 8, Ky.

Moisture, Dirt, Oil Separator

A moisture, dirt and oil separator for compressed air lines and equipment is equipped with four cellular filters. The unit is designed to handle 2 million cu ft of compressed air without change of these filter elements. The model "125S," for 125 cfm at 100 lb pressure, is fabricated from 3 in. wrought iron pipe and fittings and is galvanized to resist corrosion, the manufacturer reports. Beach Precision Parts Co., 120 Mechanic St., Boonton, N. J.

New Tubing Process

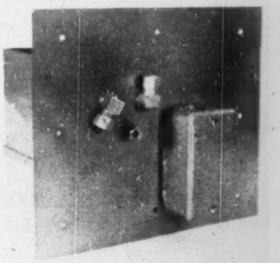
A new process whereby tubing can be created within a single homogeneous sheet of metal will be of major use in the heating, air conditioning and other industries, its manufacturer says. Refrigeration evaporator plates, condenser coils, and radiant heating panels are some of the suggested uses.



Two flat pieces of aluminum, or other nonferrous metal, are cut to size and cleaned. A silk screen pattern of the shape and size of the tubing wanted is applied to one plate. Then a stop-weld material which will prevent the bonding of the pattern area is applied. The two plates are placed face to face to form a metal "sandwich." They are spot welded together and then heated and rolled to complete a bond.

After an annealing process, one end of the new elongated metal plate is trimmed. Hydraulic pressure of 3000 lb, applied through a needle inserted into one end of the tube pattern, pushes out the pattern area which has not been bonded. Olin Mathieson Chemical Corp., 505 Park Ave., New York, N.Y.

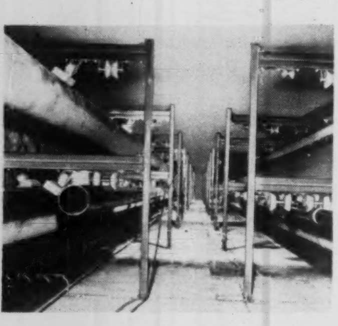
Thermal Humidifier



This thermal humidifier utilizes an electric heating element which is automatic in its operation, its manufacturer states. According to the company, the unit diffuses over 4 gal of water in 24 hours in the form of vapor emanating at 200 F. Metal parts in contact with water are of brass and copper. An asbestos gasket is furnished for backing to the face plate. Flight Mfg. Corp., 925 N. 8th St., Camden 2, N. J.

Framing for Pipe Installation

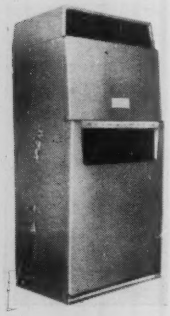
Shown is a partially completed installation of piping in a 300 ft tunnel using manufacturer's "Multi-A-Frame" concrete inserts, pipe clamps, roller pipe supports and channel bracing. Bracing supports great weight and allows for pipe expansion, according to the company, and installation requires only a saw and wrench. Structures are designed for dismantling and reuse. Multi-A-Frame Div. of Ainsworth Mfg. Corp., 1471 E. Atwater, Detroit 7, Mich.



New Line of Heating Equipment

A new line of heating equipment for use in institutions and commercial buildings includes heat exchangers, receivers, blow down tanks, boiler breechings, oil storage tanks, and custom assemblies for all types of large heating installations, according to the manufacturer. The company says the line was necessitated by what was termed "demand from commercial contractors for a single source to supply all units for any given job." Acme Welding, Div. of The United Tool & Die Co., West Hartford, Conn.

New Air Conditioning Units



A new line of air conditioning units ranging from 2 ton household models to 30 ton industrial models has been announced by their manufacturer. The company says that the units were created "to meet the specific and specialized needs of various types of buildings." Included are models suitable for floor, wall and ceiling installation. Clime-Matic Corp., South Norwalk, Conn.

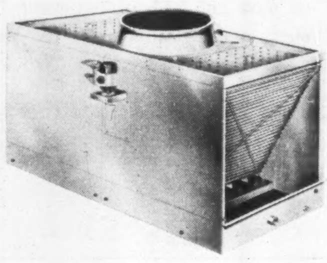
Thermodynamic Steam Trap

In a new steam trap the kinetic energy of steam closes the valve. The only moving part is the valve head, a solid heat treated stainless steel disc, designed to require very little maintenance. The same head and seat are used for pressures to 600 psi, temperatures to 950 F, the manufacturer states.

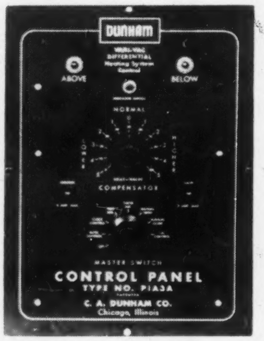
That the trap closes on no load and operates against a back pressure up to 50 percent of its inlet pressure are cited by the company. Discharges condensate at saturated steam temperature as it forms. Sarco Co., Inc., Dept. P, Empire State Bldg., New York 1, N. Y.

Packaged Cooling Tower

A new packaged steel double-flow "Aquatower," for water cooling loads in the 60 to 100 ton range, is designed primarily for air conditioning and refrigeration applications. Units are factory assembled in three subassemblies for safe shipment, easy hoisting and quick installation, the manufacturer states. Towers are equipped with multi-blade, cast aluminum pitch fans with v belt drive. Casings and basins are of heavy gauge steel. The Marley Co., 220 W. Gregory Blvd., Kansas City, Mo.



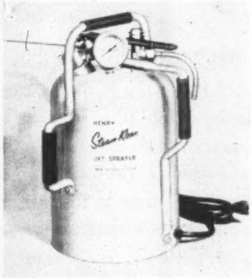
Electronic Control Panel



An electronic control panel is designed for easy installation and servicing. Moving parts are contained within a single amplifier unit which is held in place by two thumb screws and a plug type electrical connection, the company reports. No wiring connections need be broken within the panel in the installation or removal of the amplifier unit, the manufacturer states. C. A. Dunham Co., Dept. C, 400 W. Madison St., Chicago 6, Ill.

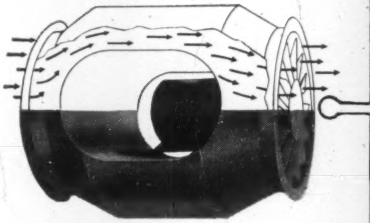
Jet Sprayer for Cleaning Equipment

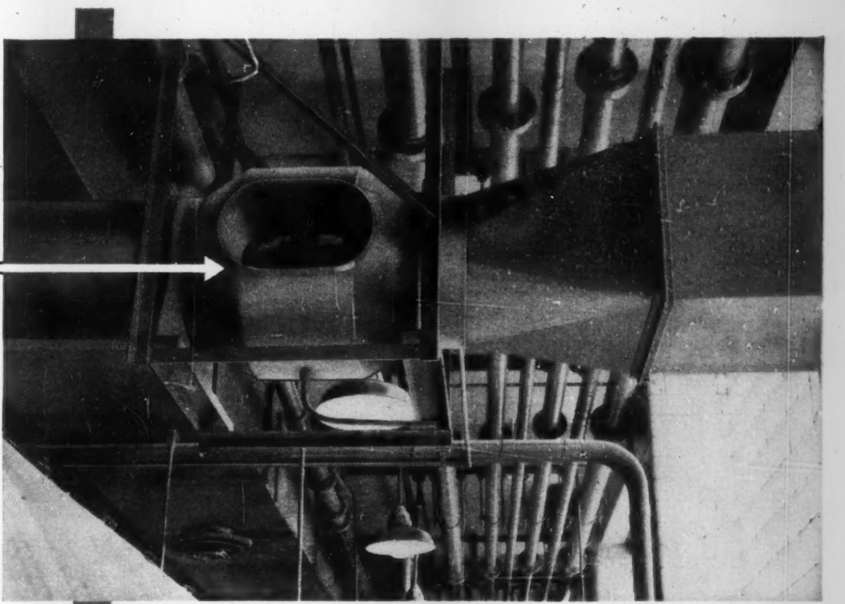
For cleaning motors, compressors, condensers, etc. without dismantling is a jet spray with feed operated by finger tip control, its manufacturer states. Changeover from wet to dry steam is done by tilting the unit from horizontal to vertical position, says the company. The sprayer has a capacity of $1/2$ gal and the manufacturer reports that it can be brought to operating temperature and pressure in 20 minutes using cold water. Henry Flow Control Co., Melrose Park, Ill.



Sanitary Pump

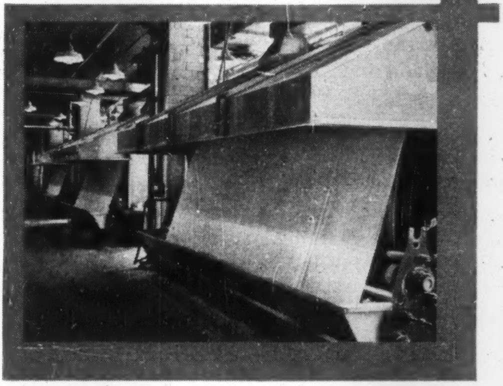
A new sanitary pump has no stuffing boxes, shaft seals, check valves or gaskets, its manufacturer re-





Bifurcators are available with fan wheels from 12" up to 48" in diameter, with exhaust capacities up to 45,000 CFM.

Sulphur dioxide fumes from the starch filters are exhausted by Bifurcator Fans installed right in the ductwork.



FUME *problem*... SPACE *problem*

BIFURCATOR® FANS SOLVE *BOTH* AT CLINTON FOODS INC.

In one manufacturing process at the Clinton, Iowa, plant of Clinton Foods Inc., starch filters give off sulphur dioxide fumes which must be exhausted. Choosing exhaust fans for this application, Clinton Foods' engineers had two major requirements. First, the fan motor must be protected from the fumes. Second, fan units must be very compact to fit into the limited space available.

DeBothezat Bifurcator Fans meet both these requirements ideally. The Bifurcator is a direct motor-driven fan in a divided housing. Its motor is in an isolated chamber around which fumes are by-passed, so that the motor stays cool, clean and accessible. A Bifurcator installs just like a flanged section of ductwork, and is scarcely larger in diameter than the ductwork.

The Clinton Foods plant now has 39 Bifurcators in operation, built of stainless steel to resist corrosion.

If *you* have a similar fume removal problem, Bifurcator Fans may be the economical answer for you, too. Why not send for an illustrated catalog now?

DeBothezat Fans

Division of
American Machine and Metals, Inc.
EAST MOLINE, ILLINOIS

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Send me free catalog on Bifurcators for exhausting hot, corrosive, flammable and explosive fumes.

FIRM NAME

ADDRESS

CITY ZONE STATE

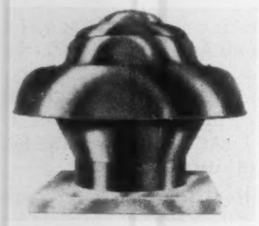
NAME AND TITLE

ports. Fluid is isolated from all moving parts. The unit is recommended for use in the chemical and industrial fields for handling viscous materials or abrasive slurries. Vanton Pump & Equipment Corp., Empire State Bldg., New York 1, N. Y.

Meter for Batching Operations

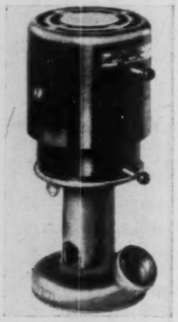
To speed batching, manufacturer's 3 in. "Auto-Stop" meter features a double-trip or "cushioned" valve that slows down the flow of liquid an instant before it trips shut. This permits very accurate cutoff with no hydraulic hammer, the company states. To operate, the tripping mechanism on the register is set by pushing the buttons on the bottom of the register until the number of gallons or pounds required shows up on the setting wheels in the window. The numerals are then cleared back to zero by turning the reset handle. Neptune Meter Co., 19 W. 50th St., New York 20, N.Y.

Roof Ventilator



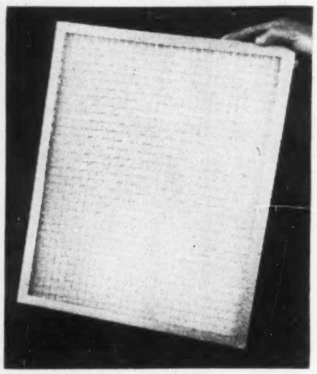
The contours of modern architectural design have been incorporated into a new roof ventilator which features a spun aluminum housing which offers lifetime weatherproof protection, the manufacturer states. Available with direct or v belt driven centrifugal fans, the "Domex," as it is called, is manufactured in a range of sizes and capacities to accommodate most ventilation problems and building designs. Penn Ventilator Co., Goodman and Allegheny Aves., Philadelphia 40, Pa.

Pump



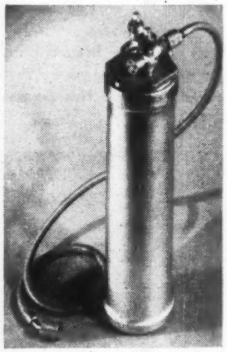
The manufacturer's "H-3000" series pump is designed to be smooth and quiet in operation and to deliver a steady flow of liquids of light viscosity. Pump is made of dense bronze castings and stainless steel with shaded pole motor that is fully enclosed and fan cooled, according to the company. Applications cited by the manufacturer are in the air conditioning and refrigeration fields. The company reports the capacity to be 10 gpm of water at 3 ft head. Graymills Corp., 3701-3733 Lincoln Ave., Chicago 13, Ill.

Air Filter



A cleanable air filter for furnaces and air conditioners has a filament body that is constructed of specially woven fibers containing positive and negative electrostatic charges that are said to retain their effectiveness throughout the life of the filter, according to the manufacturer. Air passing through the weave sets up a turbulence that generates voltage attracting dust and dirt to their opposite charges. Cleaning is done by rinsing or hosing, shaking out excess water. The filter has a frame made of "Armco Aluminized" steel. Microtron Corp., Charlotte, N.C.

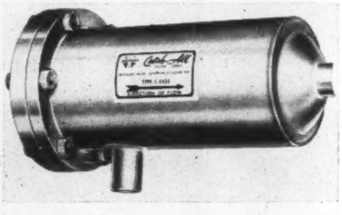
Pressurized Oiler



Incorporating a safety relief valve to guard against overfilling, a pressurized oiler is designed to add oil to inaccessible compressor crankcases. It will also remove dirty oil and sludge where no drain plug is provided, the company says. Included are a 1/4 in. flare x 1/4 in. pipe thread receiver-discharge valve with a 12 in. dip tube, and a charging valve with safety mechanism in case of overcharging. Superior Valve & Fittings Co., 1509 W. Liberty Ave., Pittsburgh 26.

Filter Driers

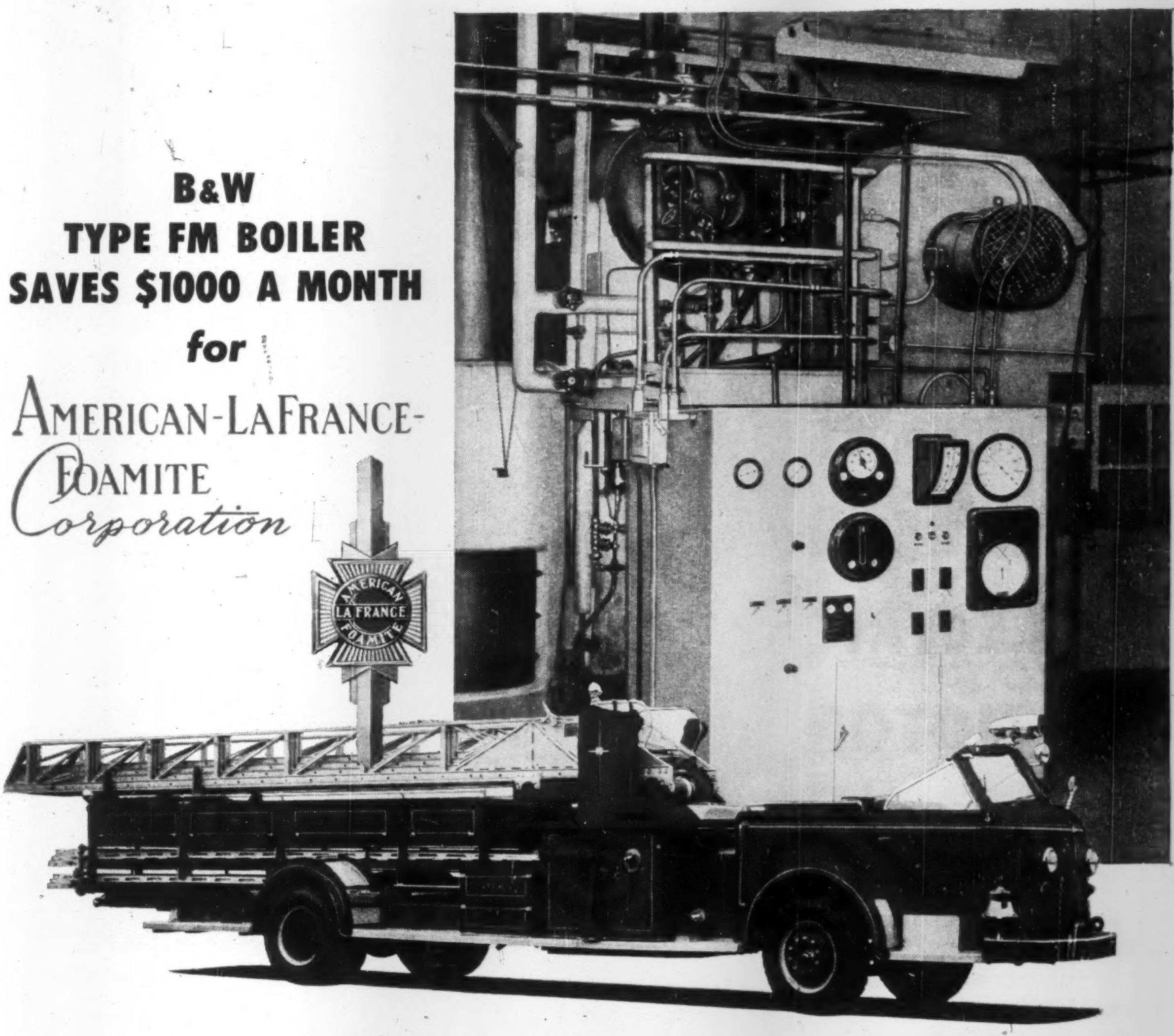
Two new series of filter driers have been added to the manufacturer's line. The C-R424 "Catch-All" shown here is designed to provide a replaceable core type drier in the small capacity range. This model can be used on air conditioning systems up to 5 hp and has a nominal capacity of 3 hp on systems operating below 32 F, the company states.



The "300" series is for use on systems up to 7 1/2 hp while carrying a nominal rating of 2 tons on systems operating below 32 F, the manufacturer reports. Sporlan Valve Co., 7525 Sussex Ave., St. Louis, Mo.

(*Continued on page* 180)

B&W TYPE FM BOILER SAVES $1000 A MONTH for AMERICAN-LAFRANCE-FOAMITE Corporation



One of the world's largest manufacturers of fire-fighting equipment has reduced its fuel and operating costs at the rate of $12,000 per year by installing a B&W Integral-Furnace, Type FM, and making other related plant improvements. It is estimated that in 6 years this B&W steam generator will pay for itself.

Tied in with the plant's existing high-pressure steam system, it will produce 8,000 lb of steam per hour in heavy-load periods and will operate alone to furnish power for low-load periods. The biggest single saving effected by this installation is fuel. Formerly a large portion of the fuel burned during the summer, averaging about 50 tons per week, was used for banking and actually served no useful purpose. The automatic oil or gas-firing feature of the FM Boiler eliminates banking. Further, the unit's compact design and completely automatic features, including the flame-failure detection device, releases operating and maintenance personnel for other duties.

The completely shop assembled, FM Boiler is virtually on the line upon arrival—needing only hooking up of service connections before it goes to work. This widely-used B&W unit is suitable for a wide range of industrial, commercial, institutional, and other classifications. It is available in standard sizes for loads ranging to 36000 lb of steam per hour, at pressures to 235 psi. It is available for higher pressures. FM units in service, and on order represent a steam output of over 9,000,000 lb per hour and considerable savings in fuel and operating costs that are well worth serious consideration.

COST-SAVING FEATURES of the B&W Type FM Boiler

- Saves Erection Time and Cost
- Meets Wide Range of Service
- Handles Quick Load Changes
- Fast Steaming
- Low Maintenance
- Easy Accessibility
- Suitable for Outdoor Service
- Burns Oil and/or Gas
- Saves Fuel
- Saves Space
- Safe, Automatic Operation

BABCOCK & WILCOX

BOILER DIVISION

G-638

AIR CONDITIONERS

FANS OIL BURNERS WASHING MACHINES

IRONING MACHINES FURNACE BLOWERS

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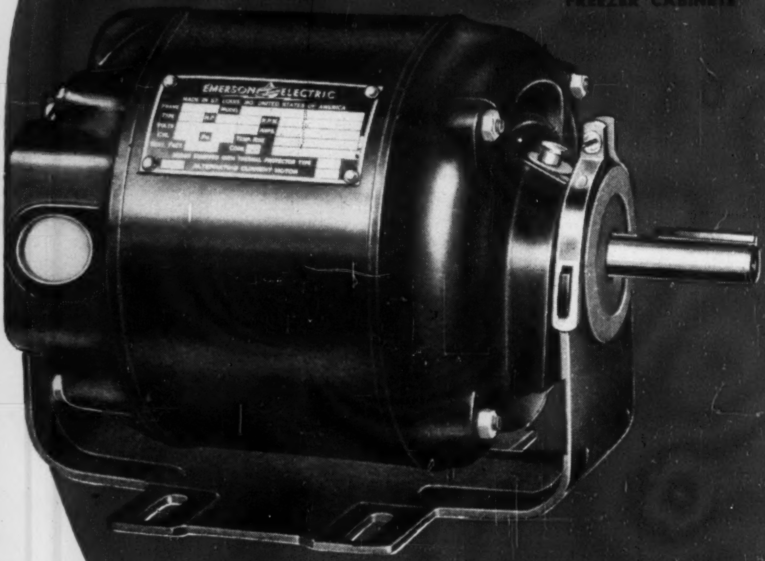
VENDING MACHINES HOME WORKSHOP TOOLS PUMPS

STOKERS UNIT HEATERS REFRIGERATORS

FREEZER CABINETS

AT THE VERY HEART OF FINE REPUTATIONS . . AN EMERSON ELECTRIC MOTOR



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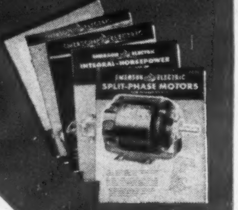


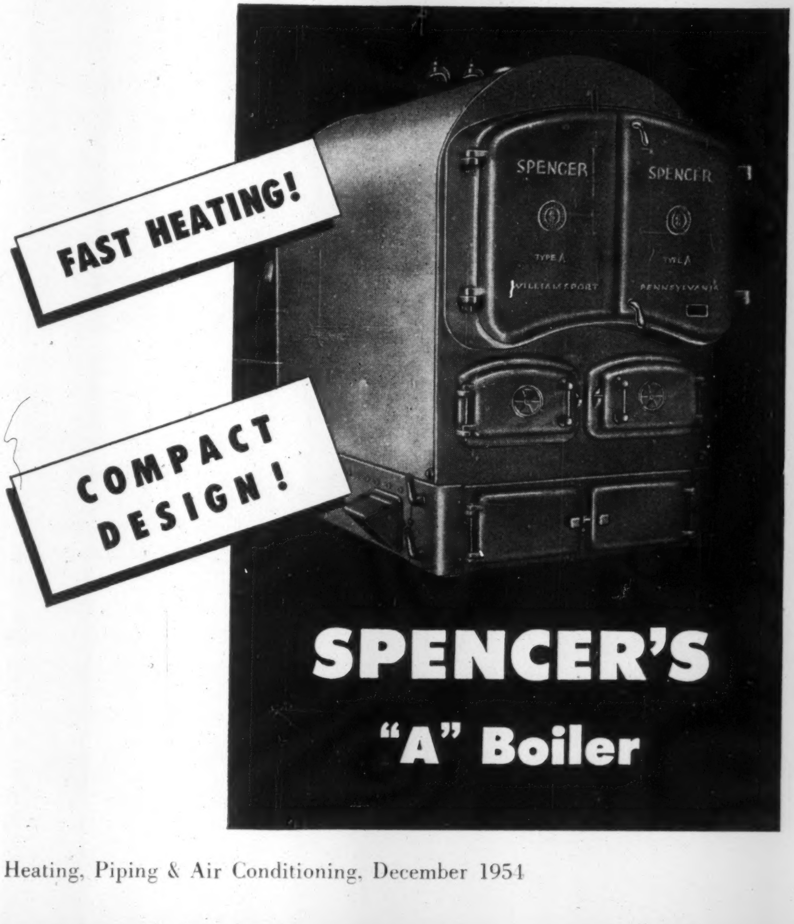
Write for information on this consulting service, or bulletins on Emerson-Electric's complete line of NEMA standard motors from 1/20 to 5 h. p. (Check Bulletin desired.)

- ☐ **M456-A Capacitor-Start**
- ☐ **M456-B Split-Phase**
- ☐ **M456-C Integral**
- ☐ **M456-D Fan Duty**
- ☐ **M456-E Oil-Burner**
- ☐ **M456-F Jet Pump**
- ☐ **M456-G Blower**

EMERSON EMERSON ELECTRIC **ELECTRIC**
MOTORS • FANS APPLIANCES

FLATTENED OUT!
(25% lower in height)
SPENCER
BOILER
DIVIDED IN HALF!

SPENCER'S
Divided L-W Boiler


FAST HEATING!
COMPACT DESIGN!
SPENCER
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TYPE A
TYPE A
WILLIAMSPORT
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SPENCER'S
"A" Boiler

SOLVE
MAJOR HEATING PROBLEMS WITH ADVANCED SPENCER DESIGNS!

Unique Low-Waterline Boiler Solves Special Installation Problems

It's 25% lower than conventional boilers of the same capacity, solving low headroom problems in existing buildings . . . excavation problems in new buildings.

Divided in half, it can be moved—one watertight section at a time—through narrow doorways.

It features all the many design dividends that provide traditional Spencer top efficiency at low cost . . . can be adapted to any fuel . . . mechanical or hand firing.

Sizes ranging from 3,500 to 42,500 sq. ft., steam.

Durable Spencer "A" Series Cuts Installation Time . . . Provides Economical Heat

Unique flue-and-smokebox units save hours in installation time.

Compact design saves valuable floor space—takes less headroom.

Special peaked firebox and staggered boiler tubes provide faster heating . . . more efficient heat transfer.

Available for stoker or hand firing . . . can be adapted to any fuel.

Sizes ranging from 3,500 to 42,500 sq. ft., steam.

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HEATER
LYCOMING DIVISION
WILLIAMSPORT AVCO PENNSYLVANIA

For information and specifications on Spencer's commercial boilers, write to: Dept. HP-124, Spencer Heater, Lycoming Division, AVCO Manufacturing Corp., Williamsport, Pa.

the best running mate *your* product can have–

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With exceptionally long life and outstanding quality built in . . . with worldwide recognition and acceptance—a Delco motor adds a unique plus value to any product it serves.

Delco fractional and integral motors are readily available in a wide range of sizes to assure you of the best running mate *your* product can have.

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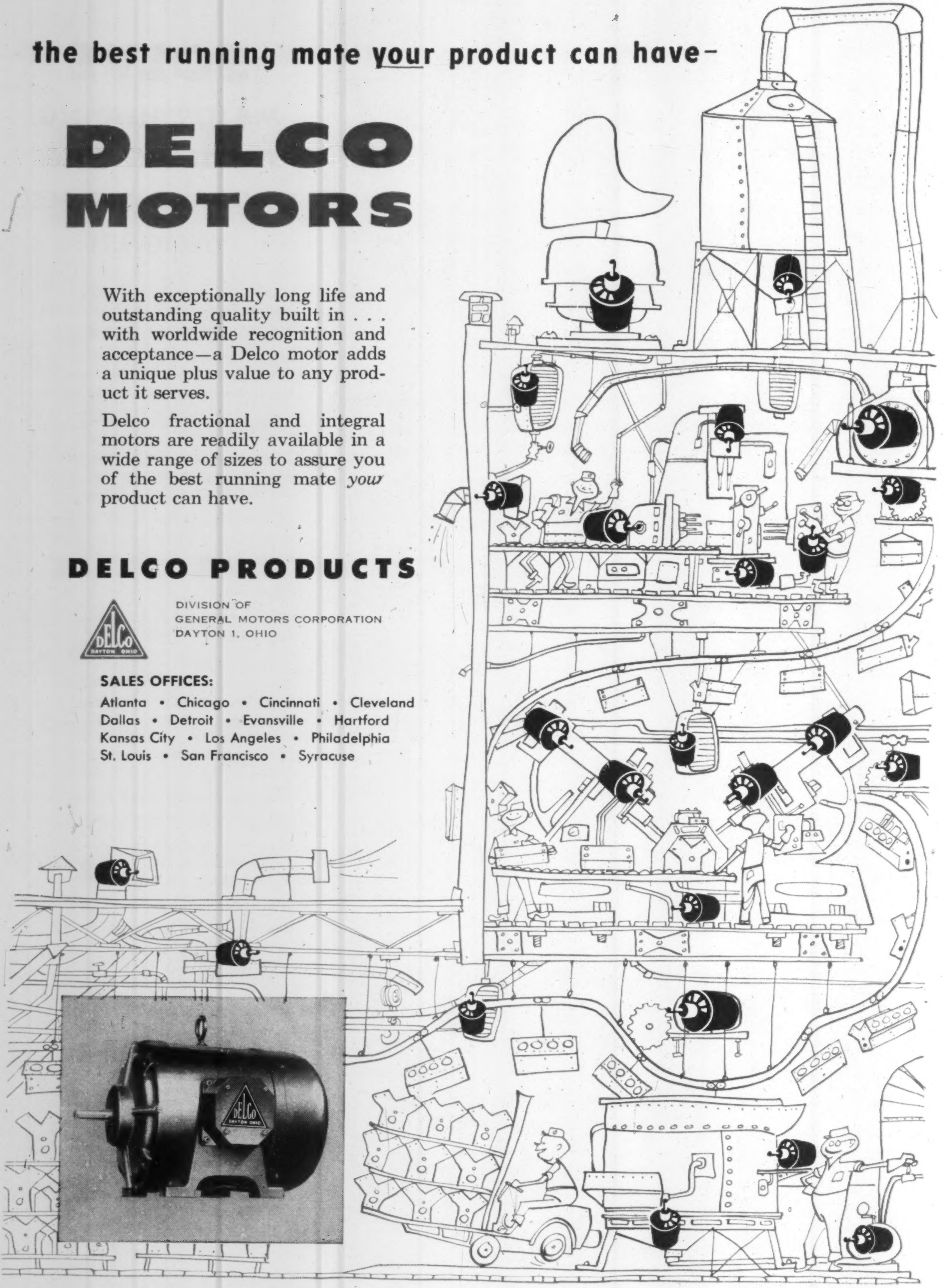

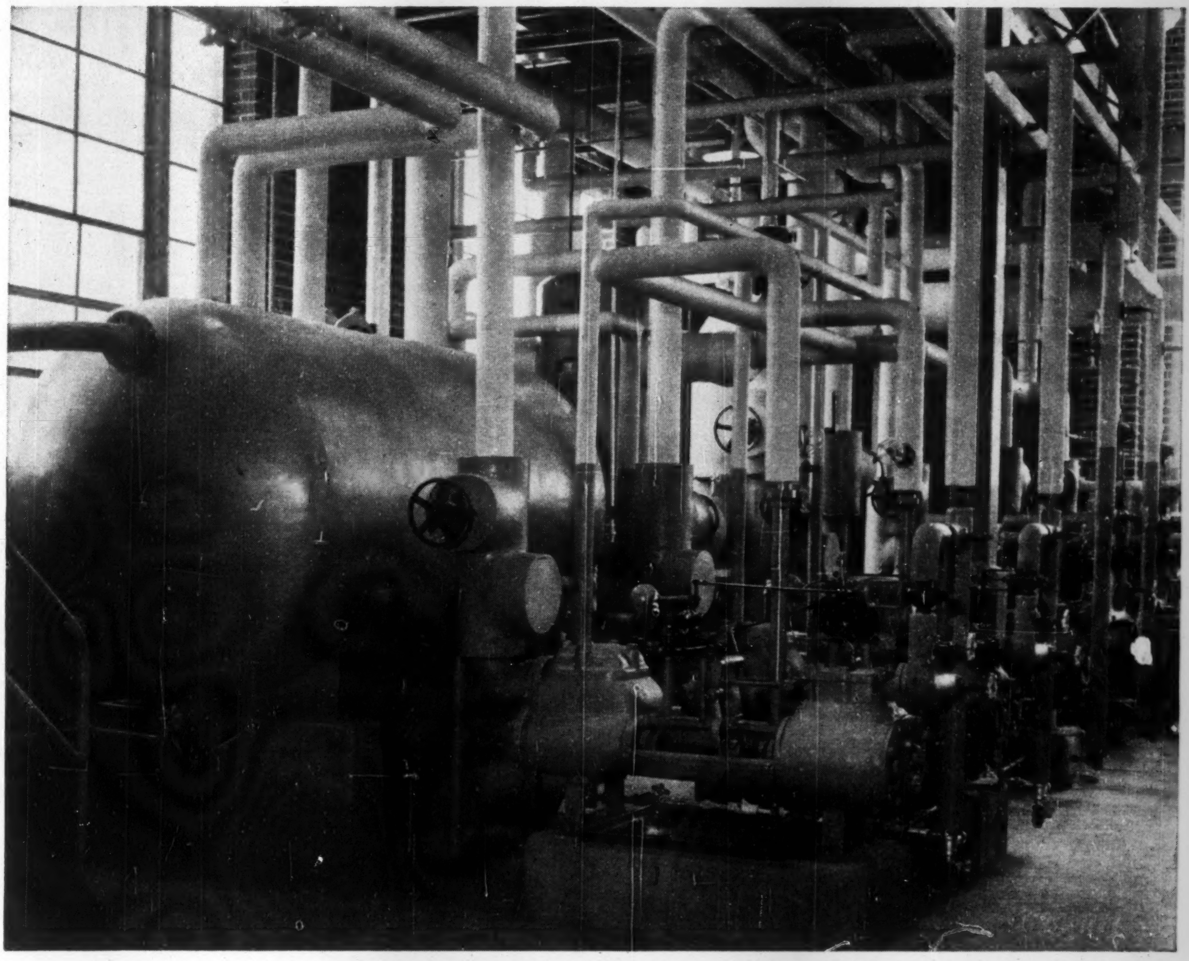

Pump room at State Teachers College in Fredonia, N. Y. "Featherweight" 85% Magnesia Insulation was installed on heating equipment and K & M Duplex Pipe Insulation was used on cold water lines. Plumbing and heating contractor — Sans Corporation, Jamestown, N. Y. — Insulation contractor — E. J. Eddy, Inc., Buffalo, N. Y. — Owner: State of New York — Architect: Cornelius J. White, State Architect.

To keep heating costs down use dependable K&M thermal insulations

Saving heat is saving money. "Featherweight" 85% Magnesia Insulation is notable for its exceptionally efficient heat conservation.

Made of 85% basic carbonate of Magnesia and asbestos fiber, "Featherweight" 85% Magnesia pipe insulation effectively insulates piping and equipment with temperatures up to 600°F. It is also available in block form for use in insulating flat, curved or irregular surfaces such as boilers, breeching, oil stills, tanks and similar equipment.

K&M Duplex Pipe Insulation has a universal liner of saturated felt impregnated with a special water-proofing compound. It is adaptable to hot or cold water pipes and is effective for temperatures between 40° and 212°F.

New and now available is "Featherweight" Water-Resistant Magnesia Insulation for temperatures up to 450°F. It is used underground where severe water exposure may damage the insulation or on indoor steam heated lines and equipment where high humidity and moisture are present.

Your K&M distributor is an experienced applicator who will gladly give you more information about these heat-saving, money-saving K&M insulations. Or write directly to us.

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K&M best in asbestos ®

General Chemical Research Laboratory located adjacent to Allied Chemical's Central Research Laboratory in Morris Township, New Jersey

Creating New and Better Refrigerants for American Industry!

This is General Chemical's new Research Laboratory in Morris Township, New Jersey. Here, General will expand and intensify its diversified research in industrial, scientific and agricultural chemical fields.

A highly important phase of the Laboratory's activities is studying ways to make good products better, more abundant and more economical. This includes continuous product and process developments with sulfuric acid and other basic chemicals, as well as with General's extensive lines of reagents and fine chemicals, and agricultural insecticides and herbicides.

"Genetron" Organic Fluorine compounds—already widely being used in refrigeration, air conditioning, and aerosols—typify the new products for modern living coming out of the Laboratory's current investigations. Many others will follow as today's experiments become commercial realities.

The research here forms the foundation for large-scale development programs at other General Chemical laboratories near Philadelphia and Baton Rouge, La. It is also closely coordinated with related phases of Allied Chemical's central research program . . . all aimed toward creating new and better chemicals for American Industry—and you!

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Allied Chemical

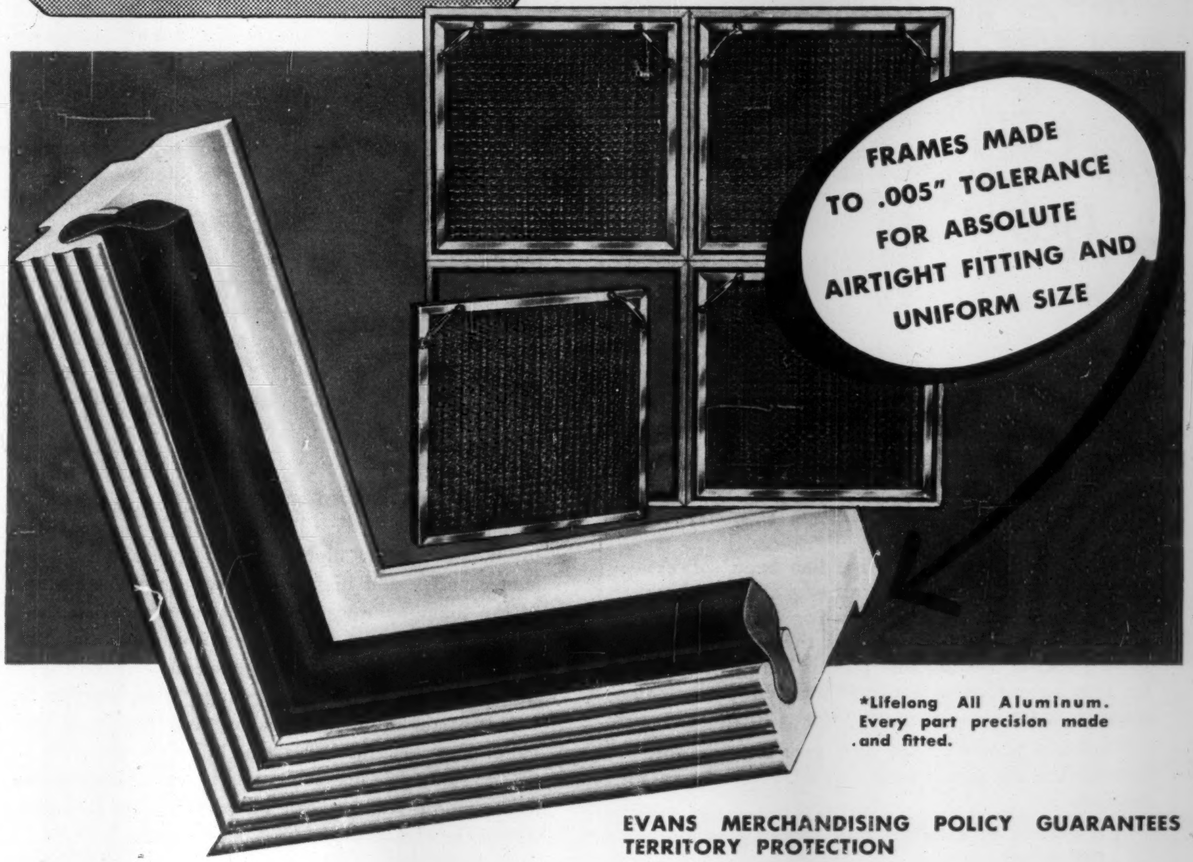
Producers of genetron super-dry refrigerants

genetron® 11 • **ORANGE LABEL**
trichloromonofluoromethane

genetron 12 • **WHITE LABEL**
dichlorodifluoromethane

genetron 141 • **GREEN LABEL**
monochlorodifluoromethane

Evans NEW . . . INDUSTRIAL Filters & Frames


FRAMES MADE TO .005" TOLERANCE FOR ABSOLUTE AIRTIGHT FITTING AND UNIFORM SIZE

*Lifelong All Aluminum. Every part precision made and fitted.

EXTRA RIGIDITY HOLDS TRUE DIMENSION AND ALIGNMENT UNDER HEAVIEST STRESS

Made of high strength aluminum alloy. Extruded for superior strength, and highest dimensional accuracy. Filter and frame unit is light. Can be carried anywhere. Easily handled. Weight (including filter, frame, handles, gasket) 16 lbs. 4 oz.

MOLDED NEOPRENE GASKET STOPS AIR AND DUST BY-PASS

Precision manufactured interlocking construction prevents air leakage. Provides proper cushioning for positive sealing. Allows easy removal of filter without releasing dust to air stream.

AS SIMPLE TO PUT TOGETHER AS AN ERECTOR SET

No complicated parts. No complicated instructions. Cuts assembly time to one-half that of conventional type frames.

EVANS MERCHANDISING POLICY GUARANTEES TERRITORY PROTECTION

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I WANT TO LEARN HOW TO MAKE MORE MONEY OUT OF THE FILTER BUSINESS.

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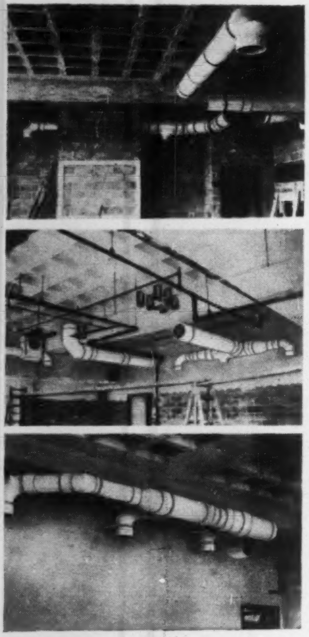
Specify the Vent Pipe that's built to last...



Transite® Industrial Vent Pipe

Stands up under corrosive conditions

Transite Industrial Vent Pipe has been successfully used for many years, in industry after industry, to overcome the corroding action of highly aggressive fumes and vapors. In the photographs shown above, this durable pipe is being installed for venting corrosive fumes so frequently encountered in chemical laboratory installations.

This vent pipe will not only give long trouble-free service, but give it with very little maintenance because:

1. **It's made of asbestos and cement—cannot rust or rot.**
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3. **It is resistant to many corrosive fumes, mists and gases.**

Transite Industrial Vent Pipe—as vents, ducts, stacks for indoor or outdoor use, for laboratories and industrial plants—is adaptable to a wide range of requirements. It is quickly and economically installed. It is light, strong and durable . . . is easy to assemble . . . can be worked with ordinary tools. Write for your free copy of DS-336 "Transite Industrial Vent Pipe for Ducts, Vents and Stacks." Address Johns-Manville, Box 60, N. Y. 16, N. Y.

Johns-Manville

TRANSITE INDUSTRIAL VENT PIPE

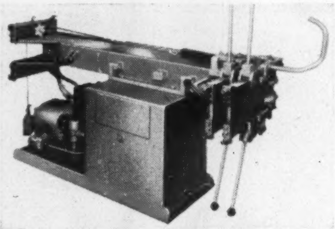
AN ASBESTOS-CEMENT PRODUCT

EQUIPMENT DEVELOPMENTS

From p. 172

Two-Way Tube Bending Machine

A horizontal semiautomatic tube bending machine for clockwise and counter clockwise (left- and right-hand) operations is designed with an extended main spindle and double ways mounted on the top and bottom of both the stationary and swinging arms. The unitized head and top assembly is double hinged to the base to permit turning over the entire assembly 180 deg, the manufacturer reports. The machine has a self contained hydraulic system, lever operated toggle-type clamp and pressure die holders, manual angle-of-bend selector with either six or eight position turret, and a 3 hp ball bearing motor. Pines Engineering Co., Inc., 601 Walnut St., Aurora, Ill.

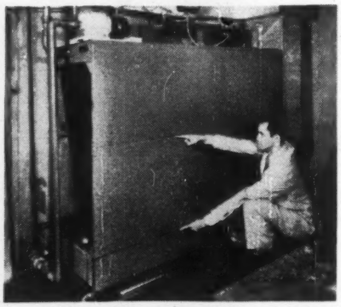


Single Phase Motor

A new line of "Tri-Clad '55'" single phase capacitor motors feature high full load speeds, high overload capacity and high breakdown torque, according to the manufacturer. Starting is accomplished by a centrifugal mechanism which throws out when the motor is up to speed, disconnecting the starting capacitors and switching the windings from starting to running condition. By reconnecting the leads, the motor can be changed from 115 volt 60 cycle to 230 volt 60 cycle operation, and by interchanging two leads, motor rotation can be reversed, the company states. General Electric Co., Schenectady 5, N.Y.

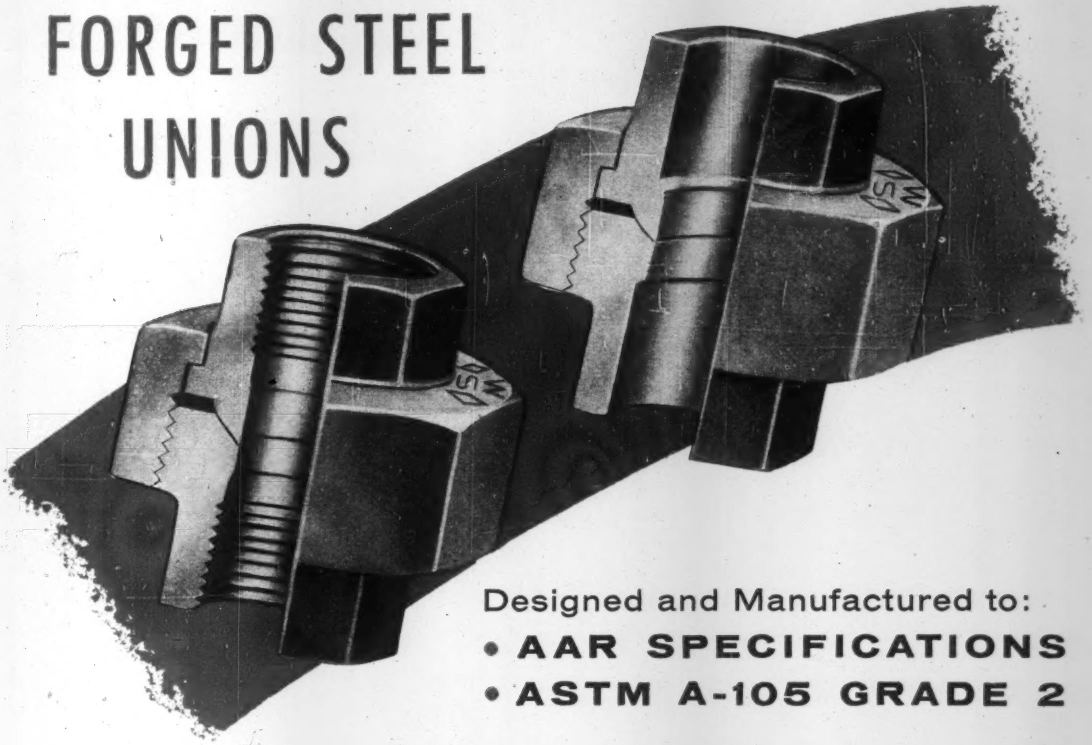
Cooling Towers

Designed to be installed in crowded basements reached by narrow stairs, or on roof tops, where the expense of a rigger for hoisting can be eliminated, the manufacturer's "Take-Apart" cooling towers permit the use of water-cooled air conditioning in quarters where it was heretofore considered impractical, the manufacturer states. Towers are shipped assembled and are then separated into several sections by removing accessible bolts. Halstead & Mitchell, Bessemer Bldg., Pittsburgh.



WATSON-STILLMAN

FORGED STEEL UNIONS



Designed and Manufactured to:

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- **ASTM A-105 GRADE 2**

We're happy to announce the arrival of these fine additions to our Forged Steel Fittings Family. Designed by Watson-Stillman engineers and manufactured on our new high precision machinery, these unions give you the utmost in serviceability in high pressure piping systems.

These outstanding features are just what you've been looking for:

1. All parts are drop-forged of high quality steel for maximum strength and toughness to resist shock and vibration.
2. Heavy, octagonal-shaped walls give you added protection at high pressures.
3. Steel-to-steel seat with ball-to-angle mating surfaces insures a tight, leakproof seal.
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Watson-Stillman Unions are available in both Screw-End and Socket-Welding Types in sizes 1/8" to 2". For complete technical information write today for our new Union Bulletin.

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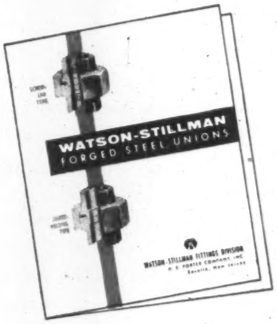


WATSON-STILLMAN
FORGED STEEL UNIONS

WATSON-STILLMAN FITTINGS DIVISION
H. K. PORTER COMPANY, INC.
Roselle, New Jersey

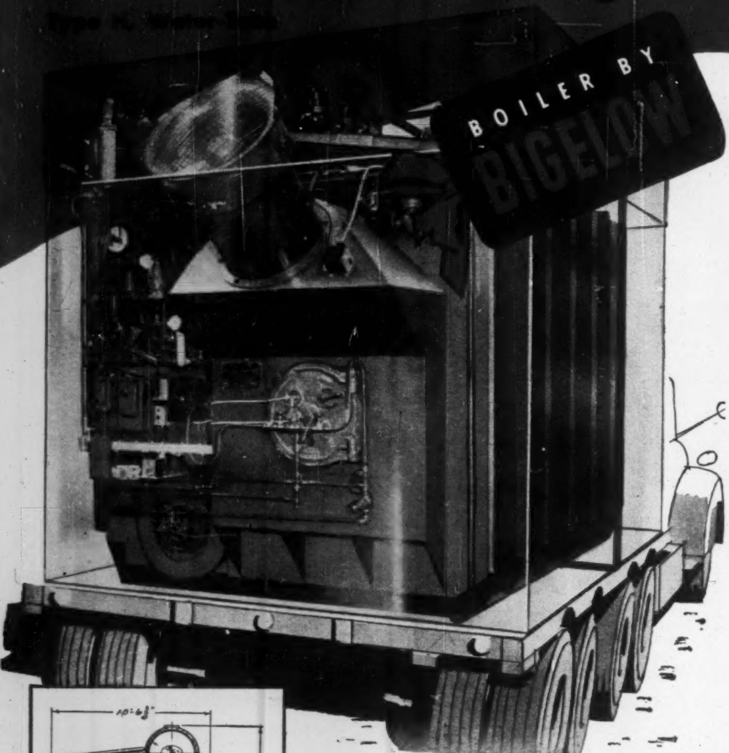
W S

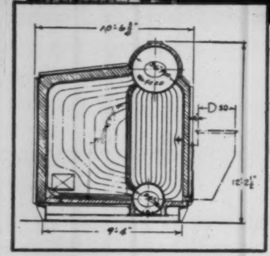
WATSON-STILLMAN FITTINGS DIVISION

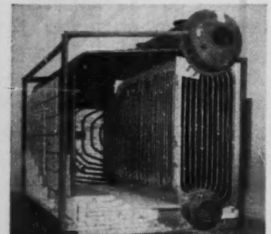
HKP **H. K. PORTER COMPANY, INC.**
Roselle, New Jersey

8

New Shop-Assembled Power Package
Type H, Water-Tube







Type H boiler in process of shop assembly.

Here's Bigelow's new, "one-piece" answer to a wide range of steam problems. This water-tube "packaged" boiler includes burner, forced-draft fan, feed water regulator, soot blower, valves, refractory, insulation, controls and accessory equipment. It is shipped complete—ready to operate as soon as service connections are made.

Advantages

Cuts Installation Costs and Time ... Requires Small Space ... Portable ... Simple To Operate ... Fast Steaming With Safety, Efficiency and Economy ... Low Maintenance ... Handles Quick Load Changes Easily and Efficiently ... Wide Range Of Service ... Burns Oil or Gas.

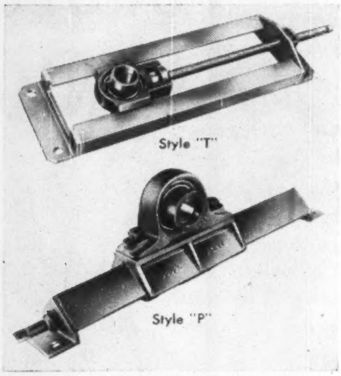
Available in standard sizes for capacities ranging from 8,000 to 30,000 lbs. of steam per hr. Write for complete catalog.

THE BIGELOW COMPANY • NEW HAVEN 3, CONN.
Established [illegible]
BIGELOW REPRESENTATIVES: Boston • New York • Chicago • Philadelphia • Syracuse • Detroit • Atlanta • Milwaukee • New Orleans • Petersburg, Va. • Washington, D.C. • San Francisco • Los Angeles • Seattle • Indianapolis • Kansas City, Mo. • Tulsa • Salisbury, Md.

EQUIPMENT DEVELOPMENTS

Continued

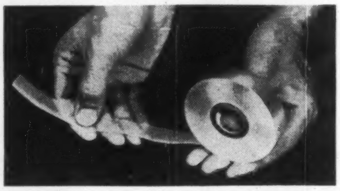
Take-Up Bearings



Style "P," designed for horizontal application, and style "T" for wall mounting, are permanently lubricated take-up bearings made of welded structural steel that can be loaded in tension or compression, their manufacturer reports. both are self aligning.

Units are equipped with standard 200 series mrc ball bearings with wide inner ring, deep ball race, groove, close curvature type providing maximum load carrying capacity with no sacrifice of radial space for shaft adaptor sleeve, according to the manufacturer. T. D. Wood's Sons Co., 1275 Fifth Ave., Chambersburg, Pa.

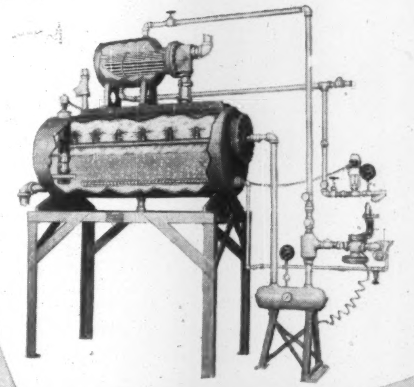
Pressure Sensitive Tape



A pressure sensitive tape that is designed to resist the action of many reactive chemicals and drastic temperature changes, is made from polytetrafluoroethylene resin and can be applied to a wide variety of surfaces as a protective covering material, the company states. It is unaffected by temperature change within the range of −65 to 350 F, the manufacturer reports. Minnesota Mining & Mfg. Co., 900 Fauquier St., St. Paul 6, Minn.

a *Fresh* approach . . . a *Major* advance . . .

in boiler feedwater deaeration



SCHAUB

ZERO-OXYGEN

Deaerators

NEW DESIGN! NEW PERFORMANCE! NEW SAVINGS!

Complete Oxygen Removal (to .005 cc/liter) • Complete Safety and Dependability • Wide Range for Load Variations • High Thermal Economy • Low Maintenance Costs • Simpler Design for Trouble-Free Service

Start with an idea that's *basically* new and better. Then produce performance beyond the best that ordinary deaerators can deliver. Schaub engineers achieved it . . . developed the all-new deaerator that's a major advance in boiler feedwater deaeration!

Two basic differences give the Schaub Zero-Oxygen Deaerator its outstanding advantages . . . note them well. First, it provides *external* pre-heating to a temperature *above* boiling point, with over-atmospheric pressure held only up to the internal sprayer manifold! Second, a free, non-restricted vent liberates *all* air *immediately* with maximum vapor heat recovery!

From these simple fundamentals stems a whole series of all-important performance benefits. Every engineer or operating man concerned with boiler feedwater deaeration should have the full facts on all-new Schaub Zero-Oxygen Deaerators. Simply send the coupon to get the complete story — promptly.

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Deaerators
a Fresh approach . . . a Major advance in boiler feedwater deaeration

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Tells why you need deaeration. Explains basic differences in deaeration systems. Here's the complete story on new Schaub Zero-Oxygen Deaerators.

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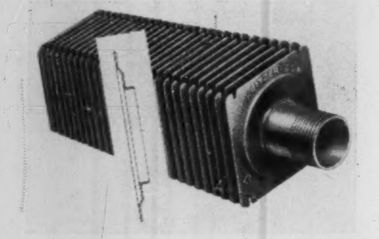
Please send me without cost or obligation, my personal copy of your new bulletin 575 on Boiler Feedwater Deaeration.

NAME________________________
COMPANY______________________
ADDRESS______________________
CITY__________ZONE____STATE________

EQUIPMENT DEVELOPMENTS

Continued

Fin Collar

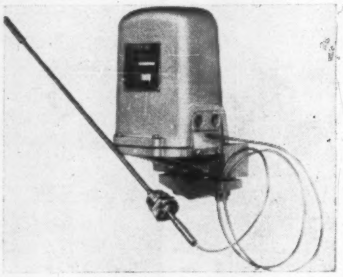


The manufacturer's retooling program includes the development of a new deep drawn fin collar designed to provide more intimate surface-to-surface contact between the fins and heat carrying tubes in both baseboard and commercial fin tubes products, the company states. Fin spacing is in standard increments of 24, 32, 40 and 48 fins per lineal ft, in sizes varying from 1 ½ × 3 in. to 4 ¼ × 4 ¼ in. in aluminum, copper or steel on copper or steel tubing in nominal sizes of ½, ¾, 1, 1 ¼ and 2 in. Certified capacity ratings as high as 14 sq ft EDR per lineal ft are available, when coils are used with matching enclosures. Kritzer Radiant Coils, 2901 Lawrence Ave., Chicago 25, Ill.

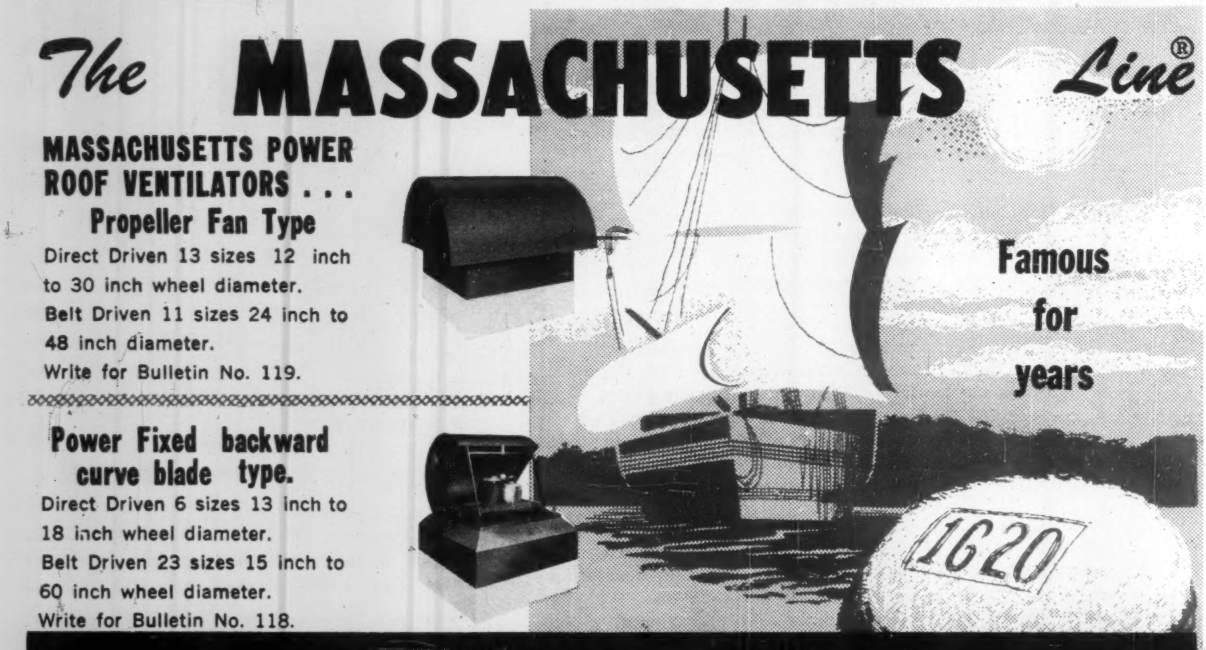
Wound-Rotor Motor

A rib-type enclosed, fan cooled wound-rotor motor, made with slip rings, brushing rigging, rotor and stator inside a single frame enclosure, is available at 1800 rpm and slower speeds, in frames 284 to 505, and in standard enclosed or explosionproof construction, according to the manufacturer. Allis-Chalmers Mfg. Co., 1171 S. 70th St., Milwaukee, Wis.

Temperature Sensing Device



A new instrument, designed to measure process temperatures and pneumatically transmit the information to a central recording or controlling station, is a nonindicating device of the "force balance" type with a reported calibrated accuracy of 0.5 percent of the temperature span and compensated for ambient temperature and barometric pressure variations, its manufacturer states. The transmitter is formulated around a gas filled thermal system which exerts force on a flapper nozzle mechanism. The resulting back pressure in the nozzle circuit, balances out the initial force and constitutes the 3-15 psi output transmitted by tubing to the receiving instrument. The Foxboro Co., 106 Neponset Ave., Foxboro, Mass.



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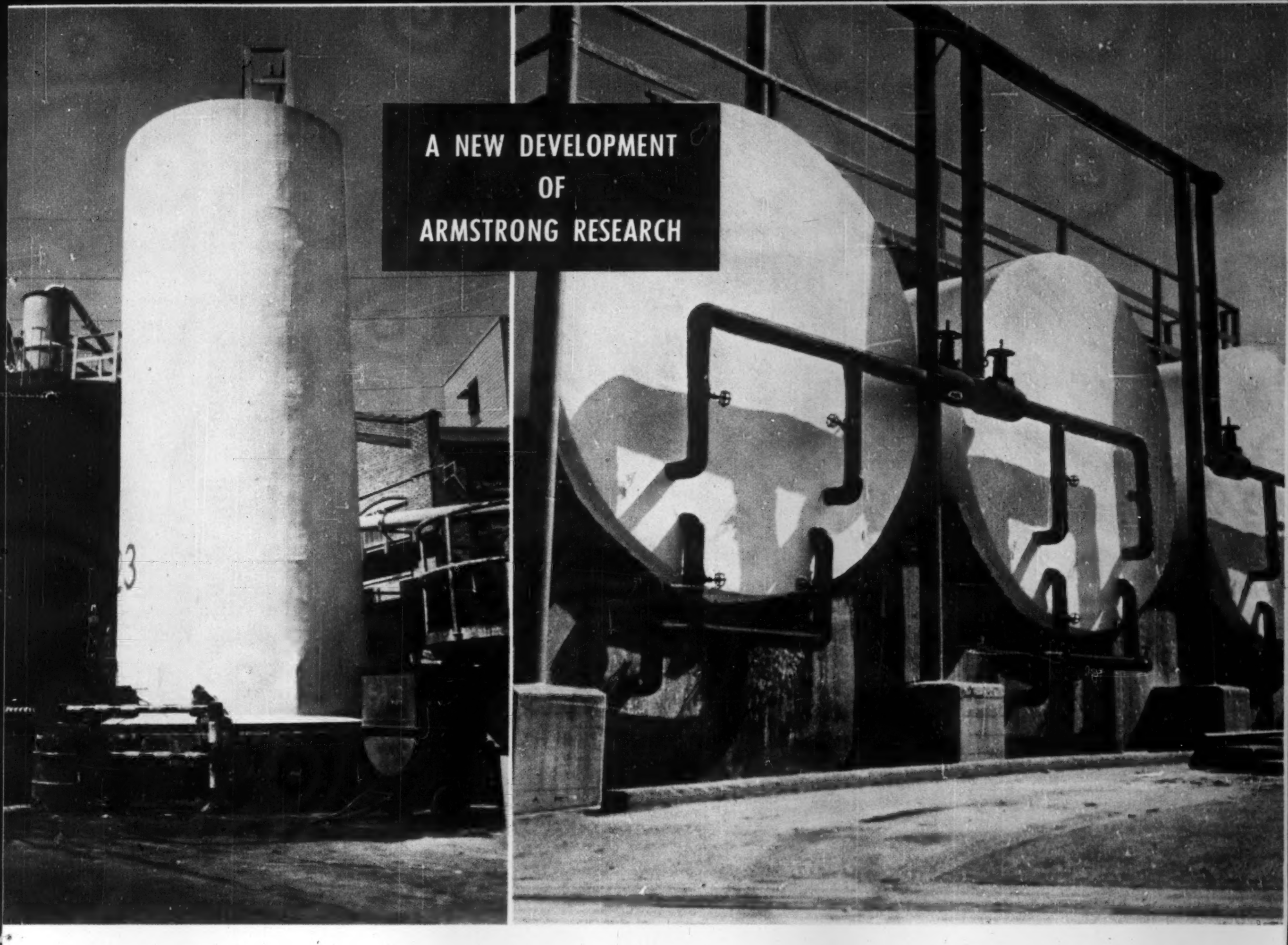
MASSACHUSETTS POWER ROOF VENTILATORS . . .
Propeller Fan Type
Direct Driven 13 sizes 12 inch to 30 inch wheel diameter.
Belt Driven 11 sizes 24 inch to 48 inch diameter.
Write for Bulletin No. 119.

Power Fixed backward curve blade type.
Direct Driven 6 sizes 13 inch to 18 inch wheel diameter.
Belt Driven 23 sizes 15 inch to 60 inch wheel diameter.
Write for Bulletin No. 118.

Famous for years

1620

MASSACHUSETTS BLOWER DIVISION
The BISHOP & BABCOCK Mfg. Co.
4901 HAMILTON AVENUE • CLEVELAND 14, OHIO



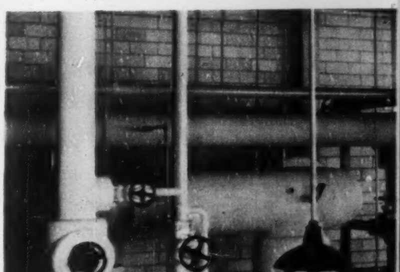
Insulcolor . . . *a rugged plastic finish for insulation— indoors and outdoors*

Now you can apply a protective finish to insulated tanks and lines that serves as color identification, too. New Armstrong Insulcolor provides a durable plastic finish in seven colors or white.

Under the most severe outdoor conditions, Insulcolor* will not crack, craze, or peel. The rugged plastic film withstands extremes of temperature and has excellent water-resisting properties. Bumping and abrasion won't damage Insulcolor's smooth, tough surface.

Used indoors, Armstrong Insulcolor is both finish and color key for all insulated steam, refrigerant, and cold water lines. It is also being widely used over cork insulation on equipment, air-conditioning ducts, and in cold rooms. Insulcolor is quickly and easily applied by brush or spray gun. It requires little or no maintenance.

Available through Armstrong's Contract Service, Insulcolor is one of the new products developed by Armstrong Research in the industrial insulation field. For full details on Insulcolor and Armstrong's Insulation Contract Service, call your nearest Armstrong office or write Armstrong Cork Company, 205 Stratton Street, Lancaster, Pennsylvania.



Both insulation finish and code color, Insulcolor eliminates stenciling or the extra expense of painting lines with identifying colors after the finish has been applied.

*Trade-mark

Armstrong INDUSTRIAL INSULATIONS

When something's got to give
to compensate for expansion,
contraction, vibration, rotation or strain,
in your piping system or equipment,
it will be far, far better for you
if the "something" that gives
is a Zallea Expansion Joint
and not your expensive piping.
Since piping damage usually
means down-time, it pays
to provide positive, over-all protection.

The expansion joints illustrated,
duo-equalizing, hinged, and universal,
are just a few of the Zallea family
of expansion joints available
to help solve your piping problems.

Regardless of piping movement,
whether axial, lateral, rotational,
etc., Zallea already has, or will
design, an expansion joint to absorb it.
For information on standard types,
request Bulletin 351. For consultation
on special problems, ask us to
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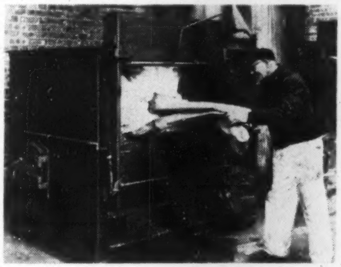
Zallea
expansion joints

ZALLEA BROTHERS, 816 LOCUST STREET, WILMINGTON 99, DEL.

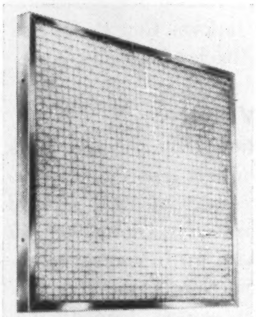
World's Largest Manufacturers of Expansion Joints

Portable Incinerator



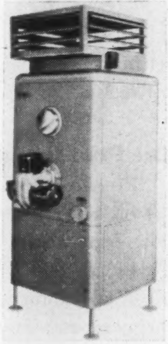
This portable incinerator, designed for the disposal of average dry waste with modifications for other types, has three standard sizes for incineration of up to 450 lb per hr, its manufacturer states. Among the model's features are a large, split - guillotine type door, a long gas travel with numerous velocity and combustion changes, a separate settling chamber, steel skids, and a top stack outlet that shortens the overall stack length required. The stack, an optional item, is self supporting. Plibrico Co., 1800 N. Kingsbury St., Chicago 14, Ill.

Air Filter

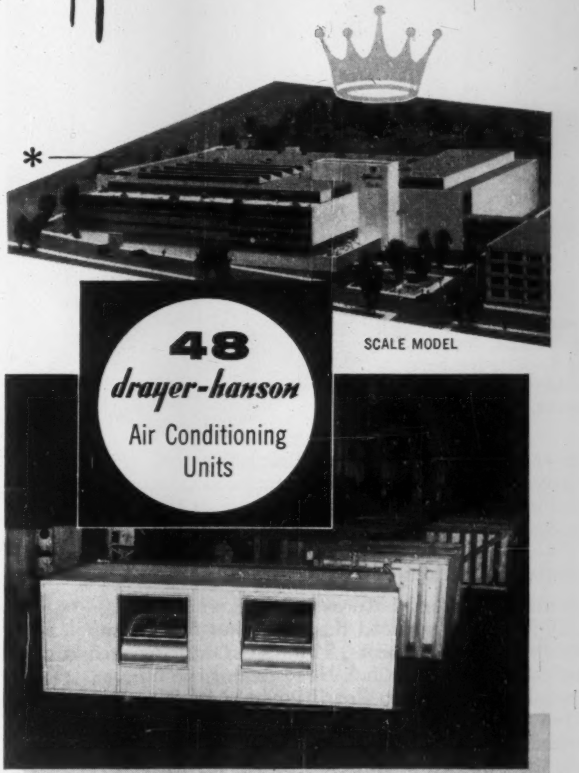


A synthetic fiber blanket for catching and retaining dust by accumulated static charge is designed primarily for use in installations of air conditioners, warm air furnaces and air handling equipment, its manufacturer states. The filter can be rinsed under a cold water faucet or nozzleless hose and returned to work immediately, says the company. Aluminum frame eliminates rust problem. Continental Air Filters, Inc., Box 1647, Louisville 1, Ky.

Space Heaters



Designated models "HB160" and "HB210," the outputs of two new furnaces are 160,000 and 210,000 Btu per hr at the bonnet, their manufacturer states. Primarily a highboy unit, application of an accessory bonnet consisting of a rectangular plenum with die formed louvers on each of its four sides transforms the furnace into a space heater for industrial installation. These louvers can be adjusted to direct air in any direction and at any horizontal pitch, according to the manufacturer. Delta Heating Corp., Cole St. and Reading R.R., Trenton 8, N.J.


"They're headed for Hallmark!"

NEW, exclusive engineering developments are landing us big prestige jobs, such as this functionally superior home office for Hallmark Cards now under construction in Kansas City, Missouri.

These Drayer-Hanson HB Series year-'round air conditioning units—so often architect specified—give you:

Rugged construction! Frame electrically welded
Superior performance! Ample prime and secondary coil surface
Longer Life! Vinyl-coated glass fiber insulation

. . . but there is more to it than that!

Write for literature—today

*Architect: Welton Becket and Associates, Los Angeles. Air Conditioning Contractor: Interstate Heating and Plumbing, Kansas City.

d-h SINCE 1910

drayer-hanson
INCORPORATED
3301 MEDFORD STREET, LOS ANGELES 63, CALIFORNIA
(A SUBSIDIARY OF UNITED STATES RADIATOR CORPORATION)

"Our decision was Janitrol Heating FOR FLEXIBILITY IN PLANT MODERNIZATION"

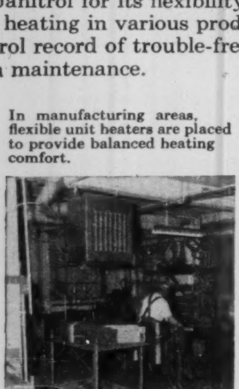
BLAIR ALUMINUM FURNITURE COMPANY
BLAIR CHAIRS

Statement by
D. M. BLAIR,
Plant Superintendent,
Blair Aluminum Furniture Co.,
Marietta, Ga.

To meet growing demand for Blair office and executive furniture, the Blair Aluminum Company moved into an existing plant with 5-times the previous floor area. The new plant was completely modernized and re-equipped for quantity production of quality upholstered aluminum office furniture.

In planning comfort features into the remodeling, Mr. D. M. Blair replaced the old stoker-fired steam system with Janitrol units. The manufacturing area is heated by 22 Janitrol Unit Heaters and the offices by two Janitrol Winter Conditioners. Mr. Blair selected Janitrol for its flexibility in providing balanced heating in various production areas and for the Janitrol record of trouble-free service with minimum maintenance.

In manufacturing areas, flexible unit heaters are placed to provide balanced heating comfort.



Office areas are heated through ducts from Janitrol Winter Conditioners in adjacent room.

®Janitrol
GAS-FIRED UNIT HEATERS

For heating any area, Janitrol Unit Heaters can provide more in performance and overall economy. For full details, write today for "The Businessman's Blue Book for Better Heating".

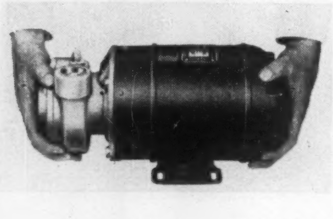
Janitrol Division of
SURFACE COMBUSTION CORP.
Columbus 16, Ohio
In Canada: Alvar Simpson Ltd., Toronto 13, Canada

ALSO MAKERS OF
Surface INDUSTRIAL FURNACES Kathabar HUMIDITY CONDITIONING

EQUIPMENT DEVELOPMENTS *Continued*

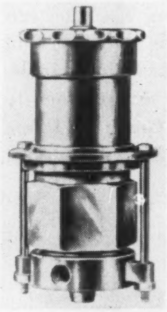
Pumps with Mechanical Seal

Type LL "Bilton" close coupled pumps feature a mechanical seal as standard equipment. The seal is designed to eliminate repacking problems, control leakage, guard against contamination of pumped liquids and protect against volatile liquid hazards. The pumps are single stage, single suction types with enclosed impellers, and are designed to require no rigid foundation or base. They deliver up to 80 gpm at 75 ft head and handle up to 150 ft heads at lower capacities. Temperatures to 150 F and suction pressure to 75 psi can be handled, the company states. Motors are available in single phase, three phase, explosion proof and direct current types. Pumps can be mounted vertically, horizontally or at any angle and pump cases can be rotated for horizontal or vertical discharge. Byron Jackson Co., P. O. Box 2017, Terminal Annex, Los Angeles 54, Calif.



Reducing and Relief Valve

A high pressure combination reducing and automatic relief valve, manufacturer's type "F," is designed for use for initial pressures to 4000 psi and reduced pressures from 2000 psi down to zero psi in controlled adjustable increments, the company says. This spring loaded, diaphragm operated combination valve can reduce high pressure air, oil or water and make these reductions down to set point without shock, states the manufacturer. The built-in relief valve is a unit that automatically opens to relieve excess if reduced pressure exceeds setting. Available in 1/8, 1/4, 1/2 and 3/4 in. sizes. Atlas Valve Co., 280 South St., Newark 5, N.J.



Oil Pressurizing for Pumps

"Pressurmatic," claimed to be the only nonmechanical oil pressurizing system for submersible pumps, is now featured in the manufacturer's "Subette" pump. This feature provides automatic sealing pressure to the oil in the motor without the use of mechanical devices, the company says. The pump is packaged for water requirements ranging from 30 to 260 gpm from wells 6 and 8 in. ID and larger. Available motor sizes range from 5 to 35 hp. Byron Jackson Co., P.O. Box 2017, Terminal Annex, Los Angeles 54, Calif.

SAFETY FILM
XX
SUPER-XX
2-B

how

FILM MAKERS CUT CASTING, CHILLING, DRYING COSTS

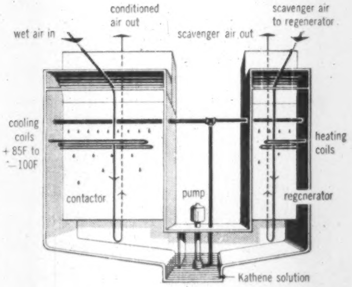
The leading manufacturers of photographic film and paper needed dry air at low temperatures for their casting, chilling, and drying processes. And they wanted it *without* frost, excessive reheating or aftercooling, high power requirements, carry-over, corrosion, and high maintenance and service costs.

They obtained air at the precise conditions they wanted by installing Kathabar humidity conditioning units, and avoided problems common to other dehumidification systems. For the casting process, where film dope changes from a viscous liquid to a transparent strip, Kathabar units deliver air at 104F and 47.5 grains/lb. with 53F water. For chilling the emulsion, they deliver air at 6.5F, 5 grains/lb., frost-free with OF refrigerant. For drying the emulsion, they provide 140F, 36-grain air, with 75F water.

The results have been better process control, improved product quality, and lower costs. One manufacturer, for example, saved $40,000 annually in excess refrigeration by using Kathabar units for drying photographic paper.

Similar results have been achieved with Kathabar units in other industries: foods, pharmaceuticals, petrochemicals, brewing, glue, candy, atomic energy, lithography. For details, write for Literature Group K54-1C, including our just-published brochure, "HUMIDITY CONDITIONING."

WHAT COULD BE SIMPLER?



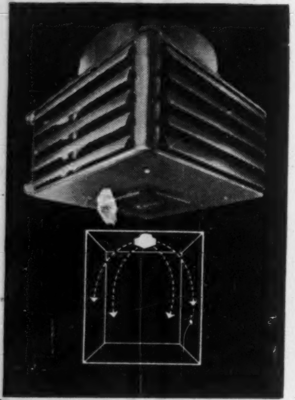
Air to be conditioned passes through the contactor, where an absorbent solution removes moisture (the amount depends on the automatically-controlled temperature of the solution). In the automatic regeneration, about 15% of the solution is heated, and the moisture it releases is blown out the window.

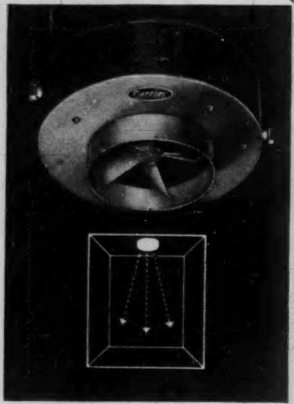
Kathabar®

HUMIDITY CONDITIONING

SURFACE COMBUSTION CORPORATION • TOLEDO 1, OHIO

ALSO MAKERS OF **Surface** INDUSTRIAL FURNACES **Janitrol** AUTOMATIC SPACE HEATING





Carrier Engineered means

Quick Heat where it counts

...plus exceptionally long unit heater life

By nature, heat rises--toward the ceiling. But these Carrier engineered unit heaters take heat at a high transfer rate from their line-connected steam or hot-water elements, transform it into warmed air and force it *downward*—vertically or diagonally. They're simple, efficient, powerful—and easy to control in volume as well as direction.

CARRIER Four-way Directed-flo Unit Heater (upper). Through independently controlled warm air streams from four easily adjusted outlets and from heights up to 30 feet, this unit provides quick heat in any direction, at any angle, in any capacity within the respective ranges of its eight sizes—82,000 to 579,000 Btu per hour.

CARRIER Projection Unit Heater (lower). This single-discharge high-ceiling type unit with wide selection of outlet diffusers is available in seven sizes and a choice of coils for low or standard temperature rise. Capacities from 32,000 to 492,000 Btu per hour.

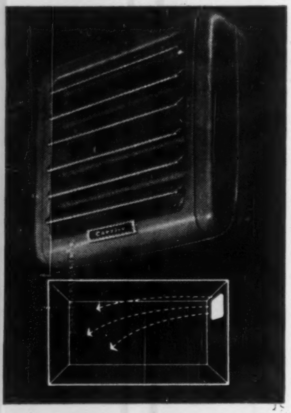
CARRIER Horizontal Air Discharge Unit Heater (right). Delivers warmed air horizontally through adjustable discharge louvres in any capacity within the respective ranges of its ten sizes of 21,000 to 200,000 Btu per hour.

CARRIER Gas-fired Unit Heaters (not illustrated) come in both propeller-fan and duct types. Solidly built—featuring exclusively **16**-gauge ALUMINIZED STEEL heat exchanger. Capacities range from 50,000 to 230,000 Btu per hour input.

For further information, WRITE Carrier Corporation, Syracuse, New York

Carrier

AIR CONDITIONING
REFRIGERATION
INDUSTRIAL HEATING

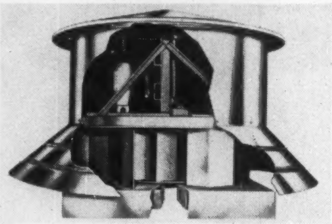


EQUIPMENT DEVELOPMENTS

Continued

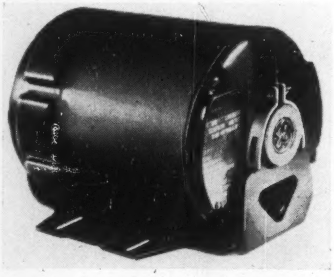
Roof Exhausters

The manufacturer's type "B" exhauster, available with either direct or v belt, has been designed for quiet operation. Noise level is kept low by an air flow design which allows low wheel tip speeds, the manufacturer says. A specially designed discharged cone utilizes the spin of the air discharged, which minimizes turbulence and discharge loss, the company states. Direct motor drive exhausters deliver from 830 to 2590 cfm in sizes ranging from 107 to 150 with static pressures from 1/8 to 3/4 in. Chicago Blower Corp., 9867 Pacific Ave., Franklin Park, Ill.



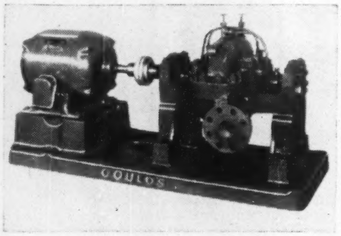
Fractional Horsepower Motor

The manufacturer's new totally enclosed, split phase fractional horsepower motor, smaller and lighter than previous models, is designed for driving equipment under severe conditions of dust and dirt. The motor has a large, built-in terminal board and base slots for simplified installation, the company's engineers state. In NEMA 48- and 56- frames, it is available in ratings of 1/6, 1140 rpm, to 1/3 hp-3450 rpm. General Electric Co., Schenectady 5, N.Y.



Two-Stage Pumps

A series of two-stage pumps for handling clear liquids, designated as the Fig. 3305 line, are available in five sizes, providing heads up to 1000 ft, and capacities up to 1000 gpm, the manufacturer reports. Opposed impellers facilitate hydraulic balance, and thrust balance is achieved by the use of a labyrinth diaphragm, the company says. Goulds Pumps, Inc., Fall St., Seneca Falls, N.Y.



THERE'S A

STAYNEW

VENTILATION PANEL FILTER

FOR EVERY TYPE OF COMMERCIAL AND INDUSTRIAL SERVICE

Ventilation and air conditioning engineers recognize the Model WKE dry-panel filter as the most efficient unit of its kind on the market today. Wide range of media is available — it operates at maximum efficiency with any medium that comes in sheet form and can be crimped. Because of its extreme versatility, the Staynew WKE filter may be used for hundreds of varied applications.

- Greater filtering area, size for size, than competitive panels.
- Construction permits wide selection of filtering media.
- Wire screen cloth front and back of medium eliminates "sagging" and protects it so that even the most fragile materials can be cleaned over and over again.
- Can be cleaned quicker than any other type panel.
- Can be washed or dry cleaned when necessary.
- Medium can be replaced quicker than in any other panel.

  Inexpensive disposable media can be furnished, if desired.

For complete information write today for Bulletin DPF-100.

Representatives in Principal Cities

MODEL WKE Dry Panel Filter Available in 2", 4", and 8" Deep Units

One exclusive advantage with the Staynew WKE is that it can be easily vacuum-cleaned in place. Saves time—reduces maintenance costs.

DOLLINGER
REG. PROTECTOMOTOR U.S. PAT. OFF.
STAYNEW FILTERS

DOLLINGER

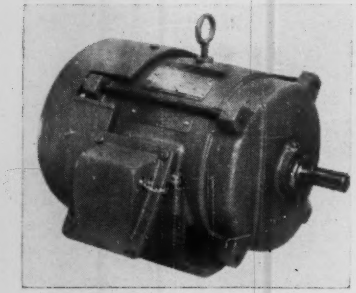
CORPORATION
9 Centre Pk., Rochester 3, N. Y.

ALL TYPES OF FILTERS FOR EVERY INDUSTRIAL NEED

EQUIPMENT DEVELOPMENTS

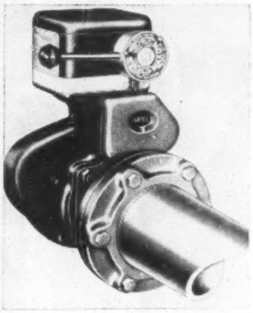
Continued

Explosionproof Motor



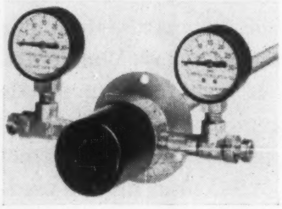
Explosionproof motors, featuring extra protection for hazardous location applications, are available in ratings from 1 to 5 hp. Motors are designed for safe applications in classified atmospheres containing flammable gases or combustible dusts. Heavier frame and end shield castings, and a machined-fit conduit box bolted to the frame, are features cited by the manufacturer. The end shields are fastened to the frame with external bolts to avoid a flame path to the interior of the motor, the company says. General Electric Co., Schenectady 5, N.Y.

Safety Valve for Fuel Lines



Designed to shut off flow of fuel automatically and instantly in case of power failure or other trouble, a 6 in. flanged type safety valve is applicable to fuel lines leading to industrial furnaces, ovens, boilers, etc., according to its manufacturer. Valves must be reopened manually after any interruption in service, and this cannot be done until the interlocking safety circuit is complete and the electric holding coil is reenergized. Maxon Premix Burner Co., Muncie, Ind.

Temperature Control

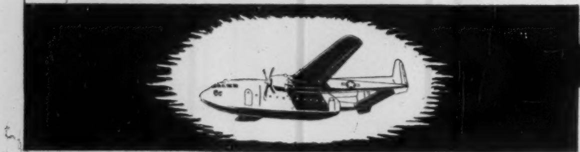


A non-bleed pneumatic temperature control for operation of diaphragm valves, damper motors and other types of control equipment is a differential expansion type designed for precision regulation of heating, cooling, ventilating, air conditioning, dew point control and industrial processes. Temperature range is from 35 to 135 F. Sensitivity can be adjusted from $1/8$ to 2 psi per one deg temperature

FAIRCHILD AIRCRAFT USES

FRICK

Air Conditioning

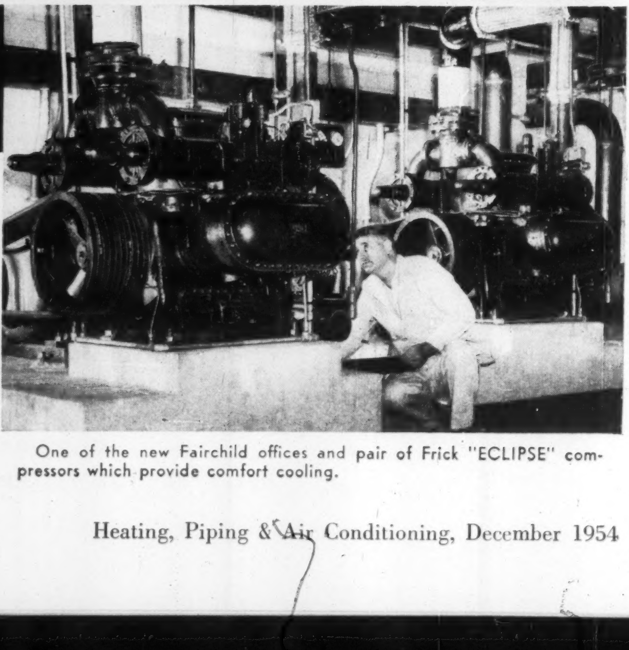


Frick Company recently completed the engineering and installation of a year 'round comfort air conditioning system for the new office annex of the Fairchild Aircraft plant in Hagerstown, Md., where they manufacture their famous C-119 Flying Boxcars.

The cooling load of 245 tons of refrigeration is carried by two Frick "ECLIPSE" 9-cylinder high-speed compressors.

For the latest in air conditioning and refrigeration engineering and equipment, look to Frick Company, now in its second century of service to business and industry.

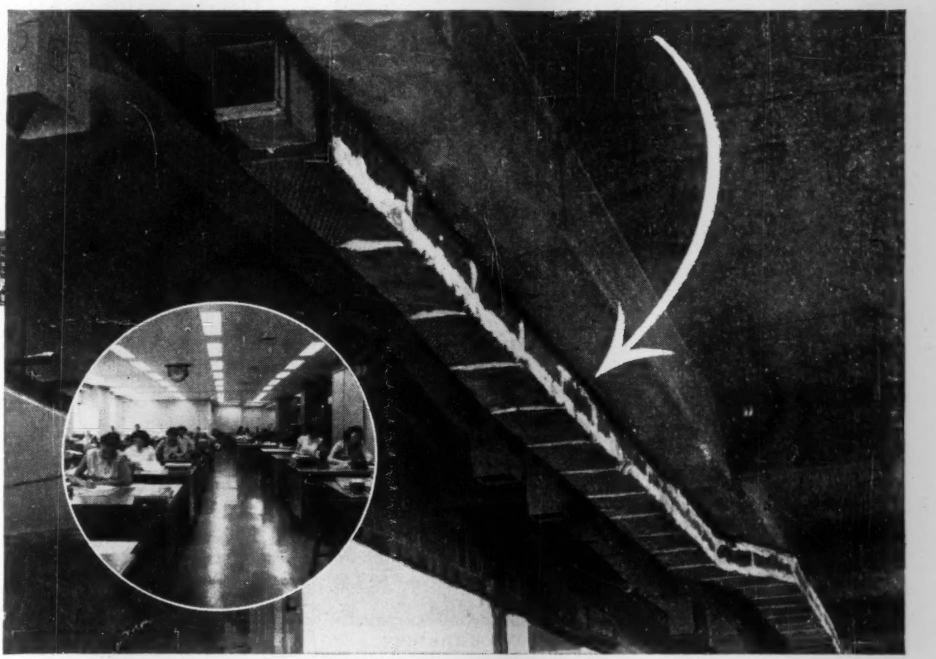
DEPENDABLE REFRIGERATION SINCE 1882
FRICK Co.
WAYNESBORO, PENNA. U.S.A.



One of the new Fairchild offices and pair of Frick "ECLIPSE" compressors which provide comfort cooling.

Above: New York City's new Chrysler Building East (foreground) and the original Chrysler Building erected some 20 years ago.

On air-conditioning ducts serving 420,000 sq ft of office space . . .



Right: Spintex insulation on the air-conditioning ducts serving offices in the Chrysler Building East. Applied by the Asbestos Construction Company, Inc. of New York, an outstanding J-M Insulation Contractor.

CHRYSLER BUILDING EAST SPECIFIES J-M *Spintex* DUCT INSULATION FOR YEAR 'ROUND OFFICE COMFORT

Running through the 32 stories of the new companion structure to the original Chrysler Building are miles of air-conditioning ducts . . . all insulated with Johns-Manville Spintex.

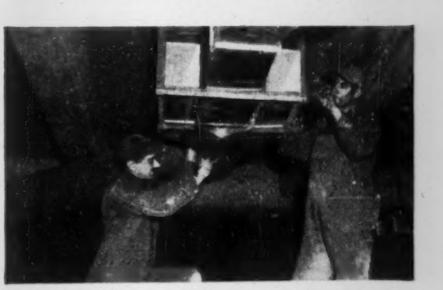
Spintex was chosen because it helps assure the greatest office comfort at the lowest operating cost. It has low thermal conductivity . . . plus resistance to moisture, fire, rot and mold growth. It is one of the most effective insulations for guarding against heat transfer and moisture accumulation.

Johns-Manville flexible, semi-rigid and rigid insulations for air-conditioning ducts meet every industrial requirement. Basically mineral products, each type has its particular characteristics that make it specially suitable for a specific air-conditioning service. All have the low heat transfer properties that are needed for high insulating efficiency.

Proper engineering and application are essential to the peak performance of any insulation. J-M Insulation Engineers and J-M Insulation Contractors stand ready to give you a top quality insulation job that will more than pay off your initial investment with maximum fuel savings.

For further information, write for a copy of Brochure IN-135A. Address Johns-Manville, Box 60, New York 16, N. Y. In Canada, 199 Bay St., Toronto 1, Ont.

JOHNS-MANVILLE JM PRODUCTS



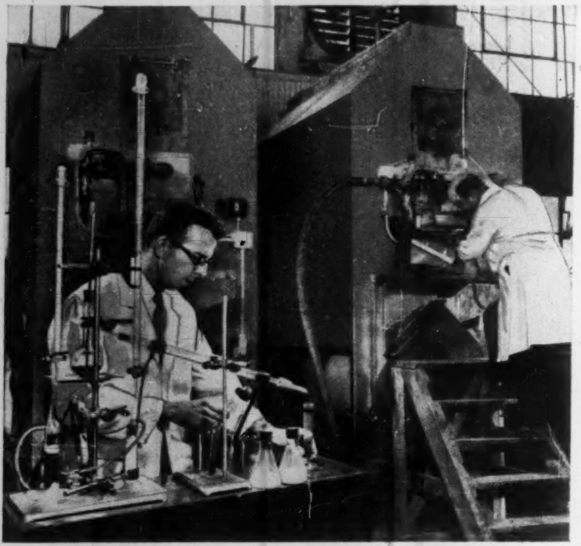
J-M insulation applicators applying Spintex on an air-conditioning duct. Thoroughly familiar with J-M insulating materials and application methods, these men have the skill that assures maximum dividends in greater fuel and power savings over the years.

Johns-Manville *FIRST IN* INSULATION

MATERIALS • ENGINEERING • APPLICATION

another

DRAVO HEATER plus!



DRAVO research brings you the best heater money can buy!

There's no guess-work in the design or manufacture of Dravo Heaters. That's because Dravo has spent thousands of dollars each year in research to make its heaters the best buy in the space heating field.

For instance, here are some of the major developments made by Dravo in their heater design and construction:

1. The over-size floating stainless steel combustion chamber which gives Dravo Heaters 70% longer service life.
2. The heavy-gauge outer steel casing provides added strength and better insulation, resulting in less than 1% heat loss.
3. Special combustion chamber design which conserves fuel, provides economical heating.
4. Fuel burners that will operate on a wide range of fuels and provide the most efficient utilization of fuel.

That's just part of the Dravo Heater story. There's more to come, because continued research is being done to make Dravo Heaters better than ever for all types of commercial and industrial uses.

This is just another reason why dollar for dollar and year for year of operation, Dravo heaters are your best heating investment.

Mail this coupon for complete information

DRAVO CORPORATION, Heating Department
Fifth and Liberty Avenues, Pittsburgh 22, Penna.

DRAVO

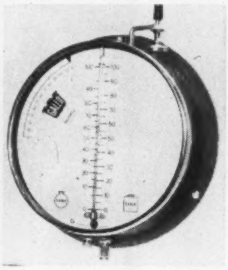
Please send me information about the Dravo:

☐ *Counterflo* Space Heater 400,000-2,000,000 Btu/hr. output
☐ *Paraflo* Space Heater 200,000-250,000 Btu/hr. output
☐ *Gas Fired* Unit Heater 68,000-180,000 Btu/hr. output
☐ Please have your representative call at no obligation to me.
Ask for Bulletin LM 599-0213

Name ________ Title ________
Company ________
Address ________
City ________ Zone ________ State ________

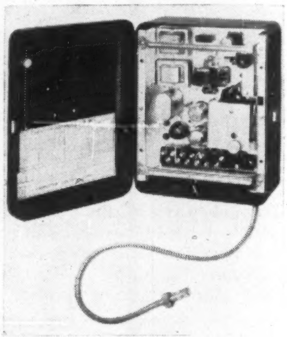
change—gradual acting. Body OD is 1¾ in. and averaging bulb length 18 in. with ⅜ in. pipe or flange connection. Is available with direct action only. The Powers Regulator Co., Dept. HCC, 3400 Oakton St., Skokie, Ill.

Liquid Volume Meter



"Gallo," a new volume meter that is designed to be used without regraduating on tanks of any size up to 11 ft in diameter (or height) and with liquids of specific gravity from 0.65 to 1.0, has been introduced in the U. S. from Europe. Reading, which expresses liquid volume in percent, is made by giving a few strokes to the pump atop the meter until the rising mercury stops climbing. This pumping brings in air until pressure in the pipe is equal to the pressure of the liquid and this is transmitted to the manometer. Manufactured by Gunnar Abrahamson Engineering firm of Malmoe, Sweden, it is being carried by Way, Wolff & Assoc., Inc., 33 Fulton St., New York 7, N. Y.

Combustion Control System



Protection against explosion hazards of burning fuel is offered to users of light oil, gas, and combination light oil/gas burners by combustion control system "FJ-2," according to its manufacturer. Employing a flame-sensitive cell, the system visually monitors oil and gas, main and pilot flames, and shuts off fuel in two to four seconds after the flame goes out. Combustion Control Div., Electronics Corp. of America, 718 Beacon St., Boston Mass.

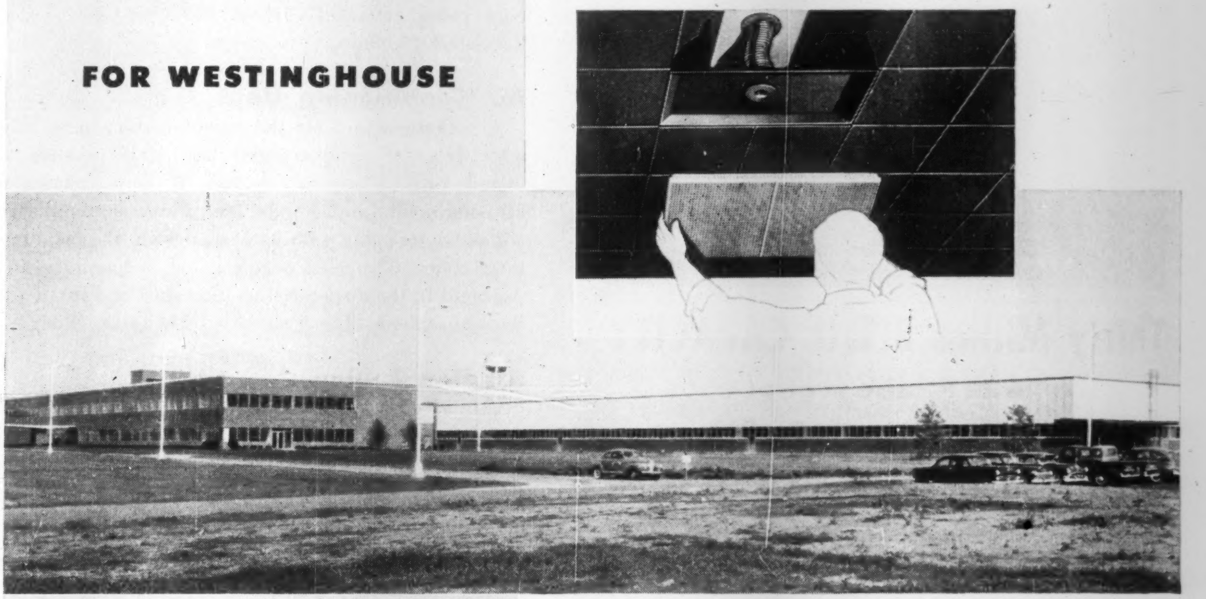
Combination Safety Valve

A combination safety valve, designed to protect against overpressure and fuel-fed fires in gas installations, can be mounted in any position, even upside down, according to the manufacturer, and can be located in any section of a piping arrangement between the gas meter and the pressure reducing valve. Valco, Inc., 1410 West Ave., Cincinnati 15, Ohio.

IDEAL "INDOOR WEATHER" WITH... multi-vent®

LOW VELOCITY AIR DIFFUSERS

FOR WESTINGHOUSE



Westinghouse Meter Division Plant, Raleigh, N. C. Robert and Company Associates, Atlanta, architects and engineers.

Partial list of prominent companies which have recently installed Multi-Vent in offices, plants and laboratories.

- Boeing Airplane Co.
- Cincinnati Gas & Power
- Dow Chemical Co.
- I. E. DuPont DeNemours & Co.
- Ford Motor Co.
- General Telephone Co.
- H. J. Heinz Co.
- International Harvester
- Eli Lilly & Co.
- Mead Johnson & Co.
- Ohio Oil Co.
- Pittsburgh Plate Glass
- Rand McNally & Co.
- Sawyer Biscuit Co.
- G. D. Searle Co.
- Sharp and Dohme
- Southern California Gas
- Standard Oil of Indiana
- U. S. Steel Corp.
- Yale & Towne

FOR GENERAL OFFICES—LABORATORIES ENGINEERING DEPARTMENTS—TEST ROOMS

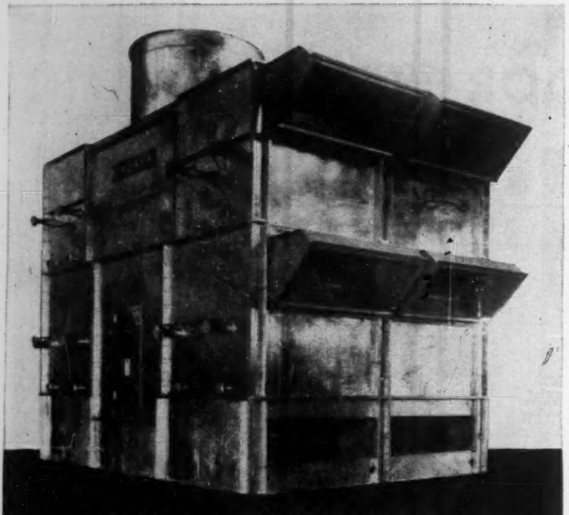
As in the Westinghouse plant, illustrated above, and in other industrial plants, Multi-Vent is specified where true air conditioned comfort or accurate control of air movement, temperature and humidity is demanded.

Because Multi-Vent is designed and engineered for easy installation and to handle high loads and high ventilating requirements, with a uniform low rate of room-air motion, it meets the most exacting demands of industrial processing and scientific research.

Flush or completely concealed in the ceiling, Multi-Vent distributes air at low-velocities by gentle pressure displacement, thus providing a degree of air conditioned comfort unmatched by any other diffuser. Write for detailed literature.

THE PYLE-NATIONAL COMPANY
1373 North Kostner Avenue, Chicago 51, Illinois

MULTI-VENT DIVISION
Sales and Engineering Representatives in Principal Cities of United States and Canada



NIAGARA Aero HEAT EXCHANGER

Thirty Million B.T.U. CAPACITY

with Precise Control of Temperature in Cooling

The NIAGARA Aero HEAT EXCHANGER cools liquids and gases by evaporative cooling with atmospheric air, removing the heat at the rate of input, controlling temperature precisely. You save 95% of cost of cooling water; you make great savings in pumping, piping, power; quickly recover your installation cost.

You can cool and hold accurately the temperature of all fluids, air and gases, water, oils, solutions, chemical intermediates, coolants for mechanical, electrical and thermal processes. You obtain closed system cooling free from dirt. You solve all the problems of water availability, quality or temperature.

In CHEMICAL PROCESSES this is successfully used in cooling liquids and gases, chemical reactions, condensing distillations and reflux cooling.

Write for complete information; ask for Bulletins 120 and 124. Address Dept. HP

NIAGARA BLOWER COMPANY

405 Lexington Ave. New York 17, N. Y.

District Engineers in Principal Cities of United States and Canada

RECENT TRADE LITERATURE...

Activated Carbon

Properties and uses of activated carbon in purification, air recovery, solvent recovery, chemical catalysis, and separation processes is discussed in a new bulletin, manufacturer's form 27. Included are simplified schematic drawings of different types of systems using activated carbon. Barnebey-Cheney Co., Columbus 19, Ohio.

Air Conditioning Units

A bulletin describing the manufacturer's new "Climate Changer" line explains how it is possible to include or omit any combination of the six phases of air conditioning in using the unit. This is accomplished without interfering with its basic design, the manufacturer states. The units are designed to humidify and dehumidify the air as well as filter dust and dirt from the atmosphere. The Trane Co., LaCrosse, Wis.

Air Flow Tubing

Therma-Facts, the manufacturer's monthly promotional news letter, discusses in a recent number, "Thermaflex" tubing, designed to offer less resistance to air flow than conventional ducting. Typical air friction comparisons are illustrated. Flexible Tubing Corp. Guilford, Conn.

Air Release Valves

A data sheet describing the manufacturer's three different styles of air release valves used for venting air from hot water heating systems, water mains, tanks in deep and shallow well pumping systems, etc., includes a capacity table showing the cu ft of free air handled by various air release valves at different operating pressures. The V.D. Anderson Co., 1935 W. 96th St., Cleveland 2, Ohio.

Air Traps

A four page bulletin, No. 2022, describes the methods of selecting and installing the manufacturer's air traps for automatic drainage of water from compressed air inter-coolers, after-coolers, receivers, separators and drip points. Also shown are detail drawings, physical data and list prices of ball float, inverted bucket and snap-action air traps. Armstrong Machine Works, Three Rivers, Mich.

Architectural Grilles and Registers

A four page folder, bulletin No. 41, presents the manufacturer's line of architectural grilles. Grille types and designs are illustrated. Also included are data and specifications on all steel registers, ceiling outlets and louvered and fixed louver air conditioning registers and grilles. Diamond Mfg. Co., 253 W. Eighth St., Wyoming, Pa.

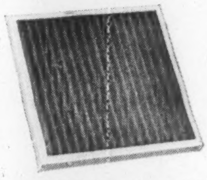
Random Thoughts from a Filter Engineer

by George Walton

- **WHAT MAKES "RECIRCULATED" AIR DIFFERENT?**
- **OCCASIONALLY WE SEND OUT A DEFECTIVE PART!**
- **SO MODERN IT STARRED IN A MOVIE!**

WHAT MAKES "RECIRCULATED" AIR DIFFERENT?

Most of the air filtered in this country is recirculated air. Home furnaces account for a large part of it. So does the practice of mixing recirculated air with fresh air in ventilating plenum chambers. All this recirculated air *is* different because it contains a good deal of bulky, linty material. This is important to keep in mind when selecting a filter because bulky, linty material usually creates problems such as rapid pressure-drop build up and difficulty in cleaning.

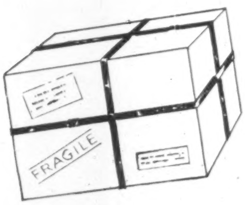


KLEENFLO FILTER

That's because the lint snags on the comparatively rough wire widely used in filter media, is hard to remove. We solved the problem in our Kleenflo filter by using smooth, round wire. And our Kleenflo has another design feature that makes it especially suited for recirculated air. Its specially pleated front face provides extra dirt collecting area to trap more linty material without undue pressure loss.

OCCASIONALLY WE SEND OUT A DEFECTIVE PART!

It's quite a confession for a manufacturer to make, but there it is—we've said it. In spite of checking and rechecking, in spite of inspectors who have been carefully trained, in spite of constant vigilance all along the line, we, like other manufacturers, occasionally crate up a defective part and send it to a customer.



We're not proud of the fact that we make mistakes. But we are proud of the fact that we back up every product we make. If our customer isn't completely satisfied, if the part in question is defective in the smallest degree, we take back the part and immediately replace it with a perfect one. And we don't make a great to-do about it, either. There are no questionnaires to fill out, no special conditions to fulfill. We simply take back the part and make it right.

This, of course, is nothing exceptional. Any reliable manufacturer will do the same for his product. The trick is to make sure the company you deal with is reliable—whether you're buying filters or fork trucks.

SO MODERN IT STARRED IN A MOVIE!

We've always thought our plant was pretty special. Recently something happened that helped confirm that belief. The plant starred in a TV movie! A local power company thought so much of our modern, up-to-date lighting system that they chose to use it as a model. So there we were, ultra-modern lighting system and all, big as life on TV!

Actually, there's a moral to this story. The rest of our plant is as modern as our lighting system. We use the most modern equipment, the most efficient methods. We know that men do a better job when their equipment and working conditions are tops. As a result, we think we have a far better chance of turning out quality products at a competitive price than a company using old-fashioned equipment and methods. We can give you more for your filter dollar.

AIR-MAZE PLANT

That Air-Maze *does* give you more is a matter of record. For 29 years we've made a specialty of giving customers extras in research, service, engineering. And at a reasonable price. The Air-Maze Corporation, 25000 Miles Avenue, Cleveland 28, Ohio.

AIR-MAZE

The Filter Engineers

AIR FILTERS • SILENCERS • SPARK ARRESTERS
LIQUID FILTERS • OIL SEPARATORS • GREASE FILTERS

Cut customer fuel bills 7 days a week

it's good business to always install a PARAGON 700 Series Calendar Time Switch on commercial heating units

YES, the good word gets around fast when a Paragon 700 Series Time Switch is on the job cutting heating bills. Heat is *automatically turned off* when not needed. Customer satisfaction through lower fuel bills *plus* fewer service "call backs" are big profit boosters for you! Check these features: :

- **COMPLETELY FLEXIBLE** — completely economical. Switch settings can be made for the entire week's schedule, yet easily and quickly changed. ON-OFF or OFF-ON operation can be as close as 3 hours.
- **FULLY AUTOMATIC** — set it, then forget it. Saves money weekends, for example: switch may be set to cut off heat Saturday noon, then automatically start regular heating cycle earlier than usual Monday.
- **INSTANTLY CHANGEABLE** — simply set the dial trippers at desired day or night hours. Total of 14 are supplied as standard equipment.

Ask for Bulletin HP-5407

See your jobber, or write:

Dial is graduated in hours and half-hours. Night and day periods clearly separated. Available in 24, 120 and 240 volts; 25, 50 and 60 cycles. No complicated wiring. Lists as low as $27.50.

PARAGON ELECTRIC COMPANY
TWO RIVERS, WISCONSIN
World's Foremost Manufacturer of Time Controls

RECENT TRADE LITERATURE *(Continued)*

Automatic Regulators

A four page bulletin, showing a selection of automatic regulators designed for use in the heating, power generating and industrial processing fields, pictures and describes eleven automatic regulating devices. Among these are high and low pressure reducing valves, relief and lever operated control valves, temperature regulators, standard and excess pressure pump governors, a pressure regulator and an air actuated pilot. Atlas Valve Co., 280-284 South St., Newark 5, N.J.

Back Pressure Valves

The application of back pressure valves for air conditioning, liquid cooling and for special installations requiring control of evaporator pressure is discussed in the manufacturer's new "Wolf-Linde" catalog. Instructions are offered for selection of the right size and type of valve for each application and information for the installation of controls is given. Dersch, Gesswein & Neuert, Inc., 4849 W. Grand Ave., Chicago.

Baseboard Air Distributors

Manufacturers of "Thermo Base" warm air baseboards announces a new catalog which gives a new method for figuring both heating and cooling installations. Complete capacity tables are given for various climatic conditions. A comparison table shows relative advantages and disadvantages of four different types of heating systems. Gerwin Industries, Inc., Dept. C, 214 Spring St., Michigan City, Ind.

Brazing

Several applications and developments of the manufacturer's metal joining products are discussed in the four page bulletin, *Low-Temperature Brazing News*. Specific uses are illustrated. Handy & Harman, 82 Fulton St., New York 38, N.Y.

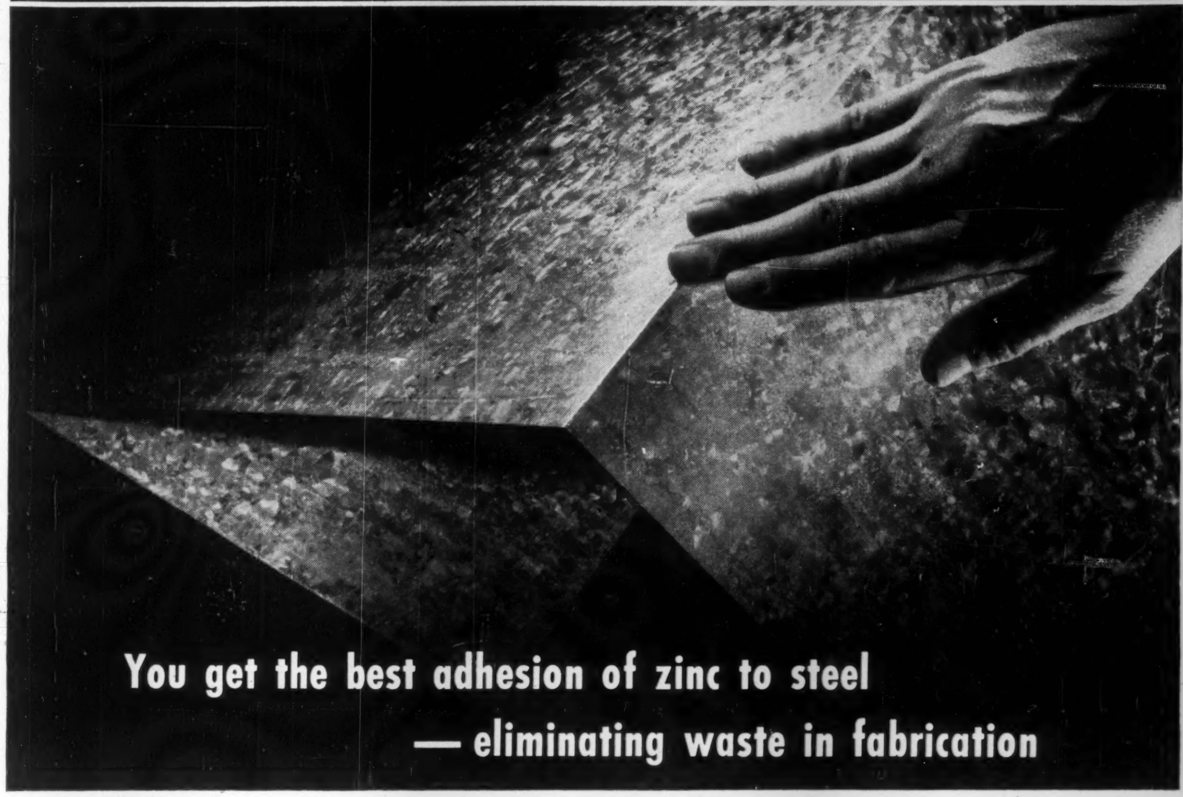
Color Guide for Unit Ventilators

A four page paint and linoleum color selection guide is designed for persons interested in unit ventilators, auxiliary cabinets and convectors for school classrooms. Linoleum reproductions are in full color while paint samples reflect a new lacquer transfer method. American Air Filter Co., Inc., 215 Central Ave., Louisville 8, Ky.

Condenser and Fluid Cooler

Bulletin 123 describes manufacturer's 400 ton capacity "Aeropass" condenser and fluid cooler. Applications cited by the company are: refrigerant condensing, vapor condensing in chemical processes, and such cooling applications as reflux and condensate, oil, chemical intermediates, quench bath, jacket water, and air and gas. Niagara Blower Co., 405 Lexington Ave., New York 17, N.Y.

WHY IT PAYS TO BUY GALVANIZED SHEETS FROM US


You get the best adhesion of zinc to steel
— eliminating waste in fabrication

• USS Galvanized Steel Sheets are noted for their unusually tight protective coating of zinc that effectively resists cracking and flaking under tough fabricating operations—bending, rolling, cutting, stamping, soldering. This means a faster, better fabricating job. And these sheets are consistently uniform in ductility, flatness and surface finish.

USS Galvanized Sheets — as well as *all* the steel sheets and strip that we sell—are the well-known, always reliable products of United States Steel . . . the world's foremost manufacturer of fine steels.

Whatever your requirements for sheets or strip, of any type, it will pay to call U.S. Steel Supply. You will get fast delivery of exactly what you need from our complete stocks. In addition, we are staffed to give qualified technical asistance in helping you solve difficult application problems. And, for cutting or shearing your sheets to size, our modern equipment means closer tolerances, less scrap loss.

In addition to USS Galvanized Steel Sheets, call us for: hot rolled, cold rolled, Vitrenamel, galvannealed, paint bond, corrugated, and long terne sheets, and hot rolled and cold rolled strip.

TRIPLE SECURITY

What you want
When you want it
At the **right price**

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UNITED STATES STEEL

U. S. STEEL SUPPLY
DIVISION

General Offices
208 So. La Salle St., Chicago 4, Ill.

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Warehouses and Sales Offices
Coast to Coast

UNITED STATES STEEL

CONSULTING ENGINEER: S. B. STRAUSS, ATLANTIC CITY
CONTRACTOR: CLAREMONT ENGINEERING, PHILA.

Now!

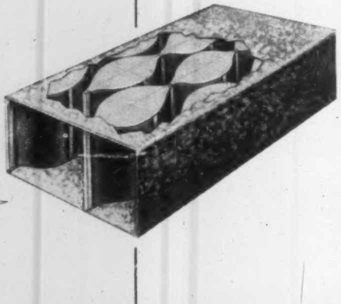
Aircoustat Silence at Atlantic City Convention Hall

Amazing Aircoustat *packaged* silencing for air conditioning is now quieting fan and air noise at this popular convention, trade show and exhibition headquarters.

Whatever the location of *your* next air conditioning installation, if *quiet* is required, Aircoustat will provide the practical, economical solution . . . just as it has at Atlantic City Convention Hall.

This compact, completely *packaged* unit is easy to install. Incorporated as part of the duct work, Aircoustat requires no special tools for installing. And results are amazing: one *7 foot* Aircoustat reduces noise level below what *100 feet* of old fashioned duct lining could accomplish . . . with low pressure drop.

Selection is no problem. Aircoustat is so engineered that if it fits geometrically, it fits acoustically.



Write TODAY for complete information on

Aircoustat

SILENCE SERVICE

Industrial Sound Control Inc.
45 Granby Street, Hartford 12, Conn.

RECENT TRADE LITERATURE *(Continued)*

Continuous Blowoff System

Manufacturer's publication 5700 describes a continuous blowoff system which is designed to maintain uniform dissolved solids concentration in the boiler to facilitate smooth steaming. Cochrane Corp., 3131 N. 17 St., Philadelphia 32, Pa.

Controlled Volume Pumps

Manufacturer's bulletin 1253 describes and illustrates how controlled volume pumps can be used as flow controllers, ratio controllers and final control elements in process instrumentation. An engineering data section contains information on how fluid characteristics and piping affect their operation. Milton Roy Co., Station Y, 1300 E. Mermaid Ln., Philadelphia 18, Pa.

Controls Catalog

A new catalog furnishes information on all the manufacturer's automatic controls for heating, air conditioning and appliances, and incorporates many new products, improvements and designs. Product information and how-to-select data is provided. Perfex Corp., 500 W. Oklahoma Ave., Milwaukee 7, Wis.

Convectors

Covering its convector line, the manufacturer has released a 24 page booklet containing descriptions, photos, specifications, construction and application information on "Airtherm" convectors. Tables and charts show capacities of various models. Airtherm Mfg. Co., 700 S. Spring Ave., St. Louis 10, Mo.

Cooling Tower Bulletin

Cooling Water for Industry, a two color, 36 page brochure, describes the manufacturer's induced draft cooling tower construction. Illustrated with photographs, sketches, cutaway and exploded drawings showing structural and mechanical equipment, it is written to be of interest to those with heat dissipation problems. The Fluor Corp., Ltd., 2500 S. Atlantic Blvd., Los Angeles 22, Calif.

Cooling Towers

Bulletin 312, covering the manufacturer's line of standard atmospheric spray cooling towers, contains new selection tables for determining correct tower size. Also given is information on the construction details of types "H" and "T" atmospheric towers, including overall dimensions, weights, etc. required for design and construction. Binks Mfg. Co., 3122 Carroll Ave., Chicago 12, Ill.

Copper Tube, Fittings, Valves

The manufacturer's 52 page catalog on copper tube, solder-type fittings and valves contains special sections devoted to water works fittings, flanged fittings and extra heavy wrought fittings for industrial

New Design Motor Gives 30% More Power to

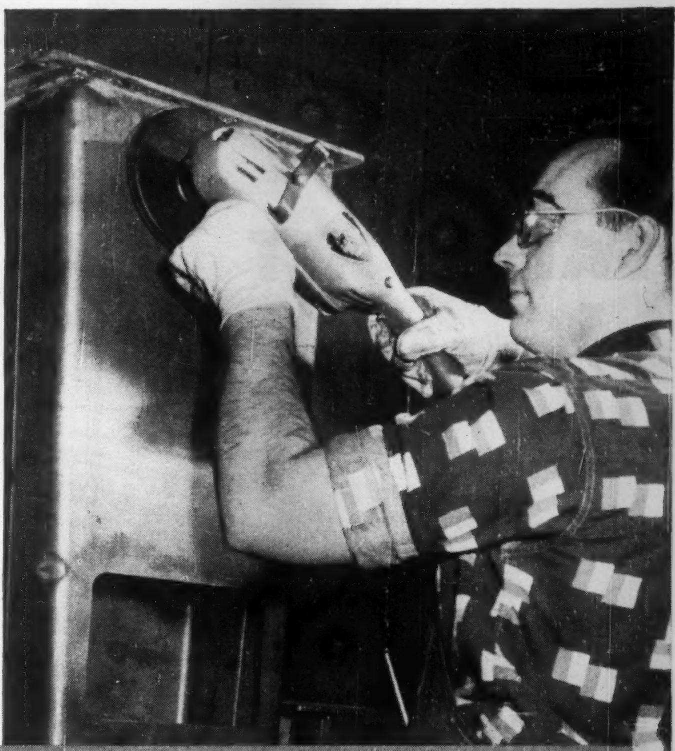
SKIL DISC SANDER

Speed Increased to 5,000 r. p. m.
for Greater Performance
On the Job!

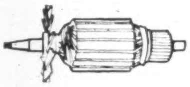
Powerful . . . fast . . . light . . . and *safe!* That's the new, improved SKIL Model 852 Heavy Duty Sander. With 30% more power for increased r.p.m. to 5,000, this perfectly-balanced sander assures you *highest maintained working speed* on all jobs.

New front handle location makes more efficient use of tool weight. Shorter length and *lighter* weight lessen operator fatigue throughout day-long use. The new SKIL Model 852 is practical, dependable . . . giving peak performance at maximum safety.

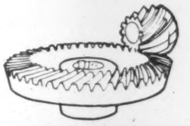
No matter what your product, nor what phase of its production is involved . . . if the problem concerns grinding, polishing, sanding, or finishing—"SKIL is the Answer"!



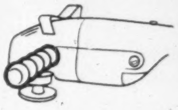
These Big Features Make SKIL Your Best Buy in Disc Sanders!



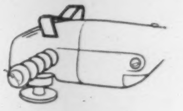
IMPROVED MOTOR!
Radically changed to give 30% more power! Maintains high load speed . . . yet runs cooler!



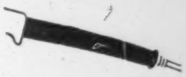
PRECISION-CUT GEARS!
Spiral bevel gears cushioned in synthetic rubber. For longer-lasting, smoother operation!



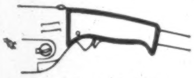
FRONT HANDLE!
Scientifically positioned for better balance and control. For right or left hand use.



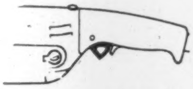
TOOL REST!
A SKIL extra for added convenience. Protects work when sander is laid down.



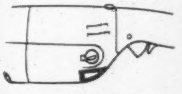
CORD PROTECTOR!
Extra-long rubber protector keeps heavy duty cord away from work area for greater safety.



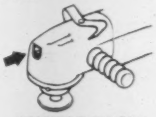
REAR HANDLE!
Scientifically contoured to fit the hand. More comfortable to use and carry to the job.



TRIGGER SWITCH!
For greater comfort in use; with continuous operation button. Dustproof, 2-pole design.

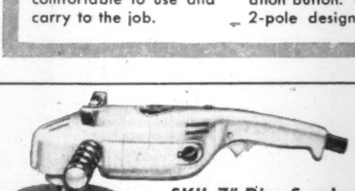


INSPECTION PLATE!
Extra large, easy to remove for complete inspection and cleaning of brushes, commutator.



SPINDLE LOCK!
Conveniently located at front of tool housing. Makes accessory changes far easier.

FREE!
Let Your SKIL Distributor Show You in a Convincing Demonstration and FREE Trial . . . that "SKIL is the Answer" to Your Metal Finishing Bottlenecks!



SKIL 7" Disc Sander
Model 851, Standard Duty

A completely *new* SKIL Disc Sander. Produces smoother, faster results with greater ease, at less cost than ever before possible. Far more power; scientific design for lighter, easier handling; dust-tight trigger switch. Ball bearings throughout.

SKIL
PORTABLE TOOLS

Made only by SKIL Corporation
formerly SKILSAW, Inc.
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Factory Branches in All Leading Cities

Mail This Coupon—NOW!

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5033 Elston Avenue, Chicago 30, Illinois

☐ I would like a SKIL demonstration and free trial.

☐ Please send me literature on SKIL Sanders and Grinders.

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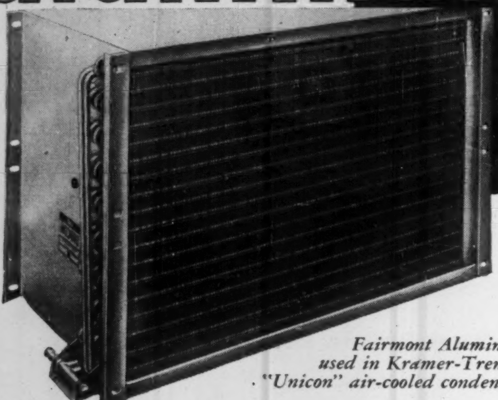

Better Yet,

USE FAIRMONT aluminum

Fairmont Aluminum used in Kramer-Trenton "Unicon" air-cooled condenser.

In finned condenser surfaces, and in all better parts and accessories for heating and cooling applications, Fairmont 2S, 3S and 52S wrought aluminum sheet is nationally recognized for highest quality and uniformity. Improved appearance, high thermal conductivity, light weight, wear-resistant ductility, and non-corrosive and stainproof surfaces—all these objectives and more are readily achieved.

Fairmont bright aluminum rolling mill products—sheet, coil and circles, are now available for prompt delivery to meet manufacturing schedules.

SALES OFFICES:
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FALCO

FAIRMONT
ALUMINUM COMPANY
•
Fairmont, West Virginia

piping, wrought copper fittings for polyethylene plastic pipe and heating specialties. Mueller Brass Co., 1925 Lapeer Ave., Port Huron 1, Mich.

Diethylene and Triethylene Glycol

Technical information on diethylene glycol and triethylene glycol, used in the plasticization of composition cork and in the dehydration of natural gas to prevent the formation of gas hydrates, is presented in a four page bulletin, F-8085. Diethylene glycol is used in making thin glues and bindery adhesives more flexible. Triethylene glycol helps to control the bacterial content of air when vaporized in specially designed equipment. Carbide & Carbon Chemicals Co., 30 E. 42nd St., New York 17, N.Y.

Diffusers, Registers and Grilles

Engineering data, performance figures, specifications and diffusion pattern photographs are included in a 28 page catalog describing the manufacturer's line of floor, wall, baseboard and ceiling diffusers, registers and grilles for heating and cooling. Lima Register Co., 651 N. Baxter Ave., Lima, Ohio.

Dust Collectors

Manufacturer's bulletin 482 reports case histories where cloth-tube-type dust collectors were employed to correct dust conditions in four different ceramic plants. Collectors employ cloth filtration, characterized by high collection efficiencies, the company states. American Wheelabrator & Equipment Corp., 1321 S. Byrkit St., Mishawaka, Ind.

Fans

Bulletin J-614 summarizes the features qualifying the manufacturer's line of 80 standard model fans for aviation and electronic applications. Specification data is included. Joy Mfg. Co., Oliver Bldg., Pittsburgh 22, Pa.

Fans

Two new brochures, one 32 pages on industrial fans and the other 16 pages on stack fans and duct boosters, contain illustrations and specification tables. Industrial fans include: axial, exhaust, extended shaft, duct and spray booth, and cooling. International Engineering, Inc., 1145 Bolander Ave., Dayton 1, Ohio.

Fuel Oil Heater Catalog

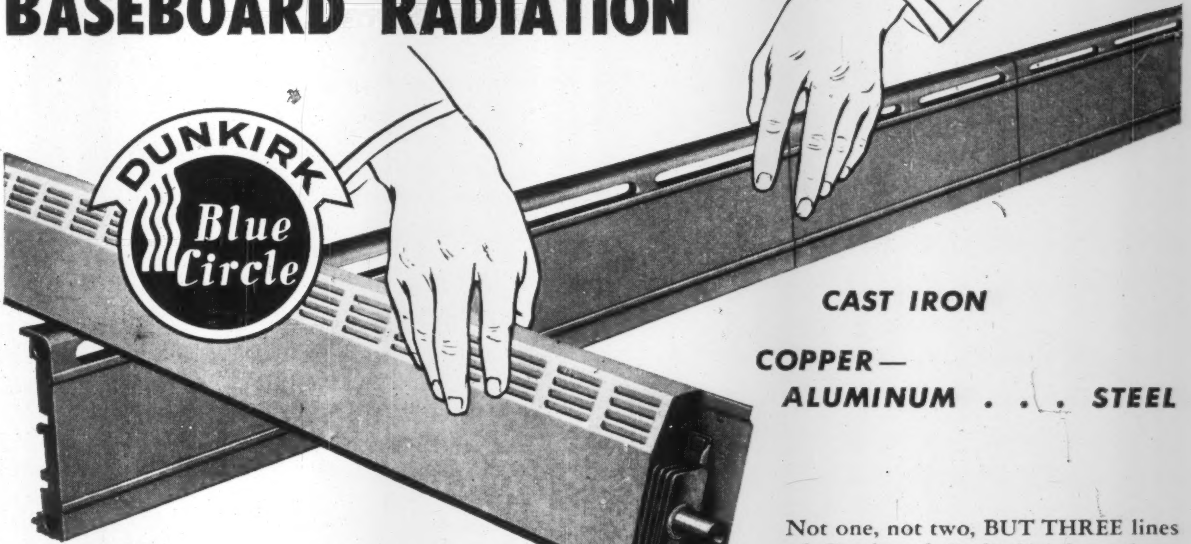
A 20 page, two color catalog covering all models of the manufacturer's line of fuel oil heaters contains detailed information as to dimension, capacities and installation diagrams. A section of the catalog has been devoted to a quiz whereby pertinent questions on heating with fuel oil are asked and answered. Manning & Lewis Engineering Co., 28-42 Ogden St., Newark.

...and now **DUNKIRK**

completes your package

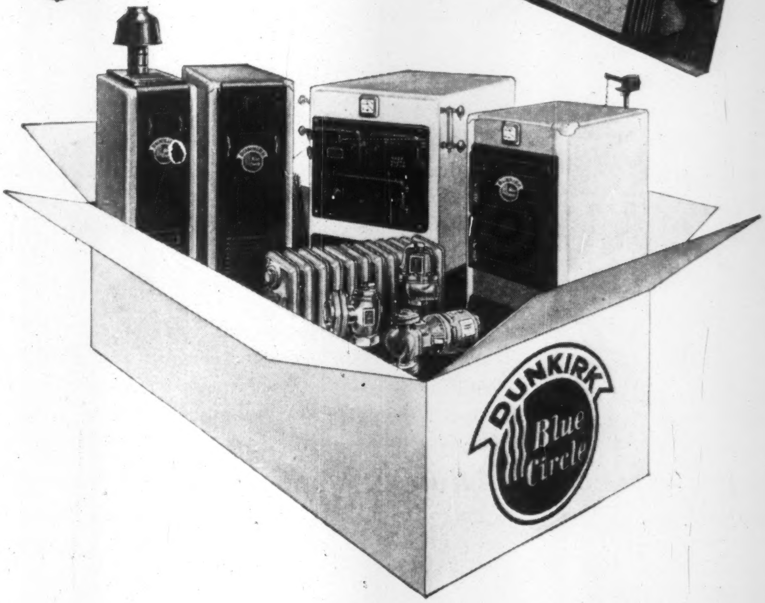
with popular NEW

BASEBOARD RADIATION



CAST IRON

COPPER—ALUMINUM . . . STEEL



Not one, not two, BUT THREE lines of Baseboard Radiation have been added to your Dunkirk Blue Circle heating package. Copper-aluminum ...steel tube and steel fin...cast iron, —you now have a 3-way choice of Dunkirk Blue Circle Baseboard Radiation to fit every job.

The Dunkirk Blue Circle package now combines Boilers, Radiation and Accessories for modern gas, oil and coal fired steam and hot water heating systems.

Designed right, built right, priced right.

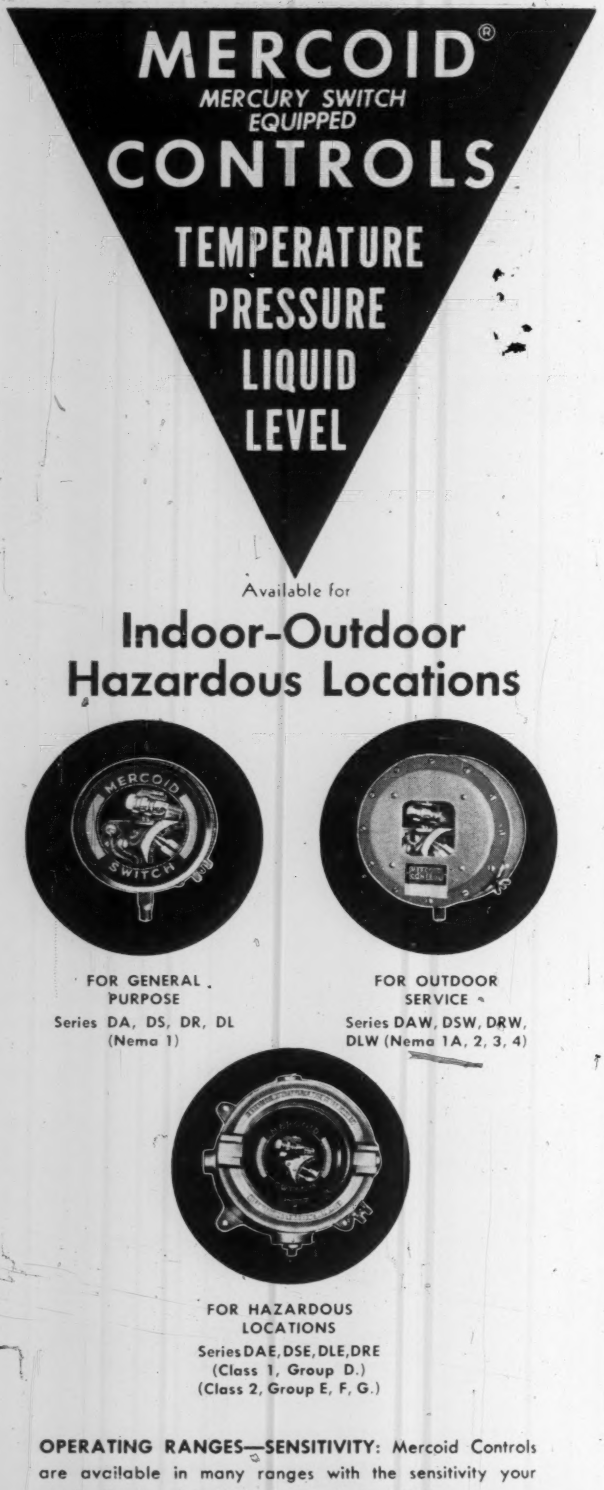
Write and discover how it pays to do business with Dunkirk.

DUNKIRK RADIATOR CORPORATION
DUNKIRK, NEW YORK

Send New Baseboard Catalog.

Name ....
Concern ....
Street ....
City .... *State* ....

DUNKIRK RADIATOR CORPORATION
DUNKIRK, NEW YORK



MERCOID®
MERCURY SWITCH EQUIPPED
CONTROLS
TEMPERATURE
PRESSURE
LIQUID
LEVEL

Available for
Indoor-Outdoor
Hazardous Locations

FOR GENERAL PURPOSE
Series DA, DS, DR, DL
(Nema 1)

FOR OUTDOOR SERVICE
Series DAW, DSW, DRW, DLW (Nema 1A, 2, 3, 4)

FOR HAZARDOUS LOCATIONS
Series DAE, DSE, DLE, DRE
(Class 1, Group D.)
(Class 2, Group E, F, G.)

OPERATING RANGES—SENSITIVITY: Mercoid Controls are available in many ranges with the sensitivity your application requires. Write for Catalog No. 700B

ALL MERCOID CONTROLS INCORPORATE SEALED MERCURY CONTACTS

THE MERCOID CORPORATION
4201 BELMONT AVENUE, CHICAGO 41, ILLINOIS
New York, 205 East 42nd Street • Philadelphia, 317 North Broad Street

Gas Burner

Bulletin 177 describes manufacturer's model "R," nozzle mix type, gas burner. Data included are specifications, electrical characteristics, and standard and extra equipment. Preferred Utilites Mfg. Corp., 1860 Broadway, New York 23, N.Y.

Globe and Stop Valves

Globe and stop valves of corrosion resisting alloys, bellows seal, diaphragm seal, "O" ring seal and conventional type of packings are described in the manufacturer's 16 page brochure. Associated Valve & Engineering Co., 1150 W. Marquette Rd., Chicago 21.

Hand and Foot Operated Valves

A 20 page bulletin, No. 303-B, describes the manufacturer's "600" and "880" series of hand and foot valves in detail together with installation data, parts lists and "exploded views" to show the assembly relationship between parts. Air flow diagrams also are provided. Ross Operating Valve Co., Dept. 1403, 120 E. Golden Gate, Detroit 3, Mich.

Heat Exchanger

A description of stock and specially engineered manufacturer's type "F" fixed tube bundle heat exchangers is given in the newly revised catalog No. 1254. The 12 page catalog contains application photographs, materials and construction features, dimensional drawings and tables. Four pages are devoted to a guide to heat exchange selection. This data includes tables and formulas for selecting exchangers involving the most common cases of water-to-water and water-to-oil heat transfer. Young Radiator Co., Racine, Wis.

Heating Valves

Manufacturer's bulletin 215 gives official rating data for new safety and relief valves. Includes illustrations and specifications. Kunkle Valve Co., 121 S. Clinton St., Ft. Wayne 2, Ind.

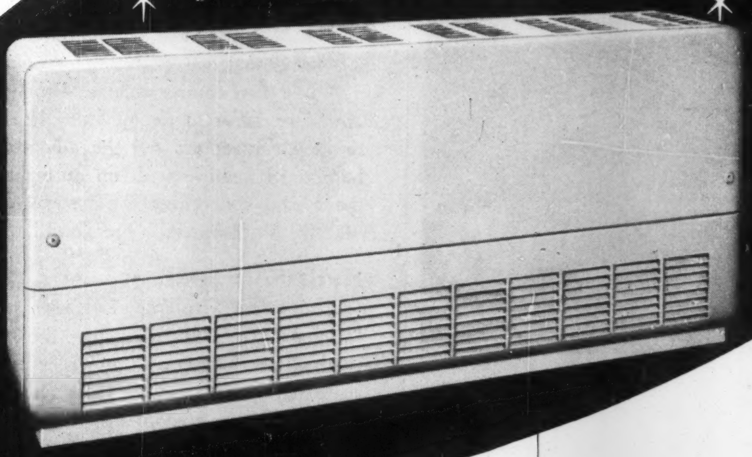
Hot Water Controls

Data bulletins on the manufacturer's line of remote bulb and electronic hot water controls are available in complete kit form. Wide range of controls offer proper equipment for any building, the company says. Barber-Colman Co., Dept. 766, Rockford, Ill.

Hot Water Heating

A line of equipment for hot water heating systems is presented in its manufacturer's recent literature. Products are flow and return balancing headers, vertical and horizontal circulators, flow control valves, distributors, air eliminators, water mixing and air vent valves, indirect heaters, tankless water heaters, control units, etc. Triplex Heating Specialty Co., Inc., Peru, Ind.

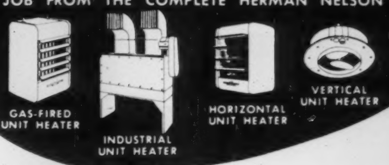
Grand New Styling...



herman nelson *Console* HEATERS

Now—here's beauty to match the efficiency and economy that Herman Nelson Heaters are famous for! The new "Console" gives you all the advantages of the popular De Luxe Heater plus completely new styling elegance. Quiet, too . . . the fan wheels turn with an almost imperceptible sound. Recessed baseboard, new key-operated 2-speed switch. Easy to install . . . operates with either steam or hot water. Eight models, for floor, wall, ceiling or recessed applications. SEND TODAY for complete information!

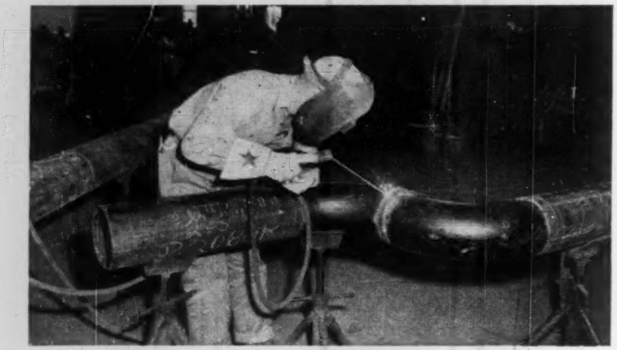
CHOOSE THE RIGHT HEATER FOR THE JOB FROM THE COMPLETE HERMAN NELSON LINE


GAS-FIRED UNIT HEATER
INDUSTRIAL UNIT HEATER
HORIZONTAL UNIT HEATER
VERTICAL UNIT HEATER

AAF
herman nelson

American Air Filter COMPANY, INC.
373 Central Avenue, Louisville 8, Ky.
American Air Filter of Canada, Ltd., Montreal, P. Q.

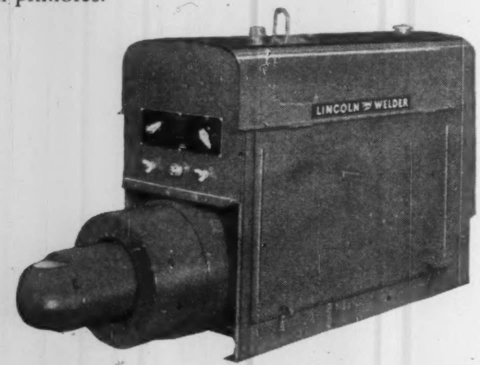
THE ACTUAL IS LIMITED: THE POSSIBLE IS IMMENSE
NEW LINCOLN PLANT CREATED BY INCENTIVE-INSPIRED CO-ACTION IN DEVELOPING POSSIBILITIES IN PRODUCT
© LE Co. 1954



HOW TO CUT PIPING COSTS

COSTLY manhours for installing pipe can be reduced substantially by careful welding prefabrication using "Fleetweld 5" electrodes and the "Shield-Arc" SA-200 welder.

Welds are made faster in flat, vertical and overhead positions . . . are more dependable for strength and freedom from pinholes.



Here's why Lincoln "Shield-Arc" is the standard of comparison for arc welders.

1. "Shield-Arc" delivers *any* type of arc . . . not just one or two types.
2. "Shield-Arc" delivers constant output of current, regardless of line voltage fluctuations.
3. "Shield-Arc" welders are constantly improved to weld faster . . . at lower and lower costs.

Benefits of lower costs on welding with "Shield-Arc" are in Bulletin 1337, available by writing on your letterhead to . . .

THE LINCOLN ELECTRIC COMPANY
DEPT. 3804 • CLEVELAND 17, OHIO
The World's Largest Manufacturer of Arc Welding Equipment

RECENT TRADE LITERATURE *(Continued)*

Hot Water Heating

Two new pieces of literature on hot water heating have been produced by a manufacturer of heating and cooling equipment. A hot water catalog, No. 1551, contains photos, application drawings and information on the complete line of hot water equipment including circulators, valves, fittings, specialties and controls.

A new two color consumer brochure entitled *There Are Two Sides to Every Story* is a booklet designed to help contractors sell the advantages of hot water baseboard heating with an automatic indoor-outdoor thermostat controlling the system. C.A. Dunham Co., 400 W. Madison St., Chicago, Ill.

Hydraulic Sealing

Customized Rubber Engineering, manufacturer's brochure No. 1090, describes the types of materials, methods, measurements and specifications used in the company's new plant in Houston, Texas in regard to hydraulic sealing problems. Plastic & Rubber Products Co., 2100 Hyde Park Blvd., Los Angeles 47, Calif.

Industrial Fire Hose, Fittings

A new color catalog, covering the manufacturer's line of industrial fire hose and fittings, includes construction details and illustrations. The eight page folder lists specifications for each type of hose as to size, weight, construction and recommended use and working pressures. Boston Woven Hose & Rubber Co., P.O. Box 1071, Boston 3, Mass.

Informational Brochure on Piping

Illustrated material on all major departmental operations of the company's eleven divisions is contained in a 50 page brochure, *This is Blaw-Knox.* Chief emphasis is placed upon products and services and their industrial applications. The Power Piping and Sprinkler Div. is discussed. Blaw-Knox Co., Farmers Bank Bldg., Pittsburgh 30, Pa.

Instrumentation

A general bulletin features the new line of metagraphic pneumatic transmission instruments, which divide the functions of measuring, recording and controlling into three separate instruments designed for flexibility in application. The Bristol Co., P.O. Box 1790, Waterbury, Conn.

Instrumentation

A 12 page catalog with illustrations, descriptions and basic specifications of the manufacturer's line of instrumentation includes: variable area and variable head flow meters, and pressure, temperature, liquid level, density and specific gravity measuring, viscosity and consistency, and recording and controlling instruments. Fischer & Porter Co., 172 Jacksonville Rd., Hatboro, Pa.

From the ground up...
MORE AND MORE USES FOR
WHEATLAND STEEL PIPE
WHEATLA
WHEA

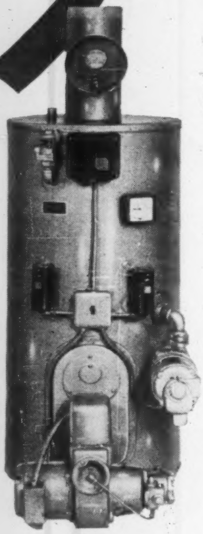
WHEATLAND TUBE COMPANY BANKERS SECURITIES BUILDING • PHILADELPHIA • PA. • MILLS: WHEATLAND • PA. DELAIR • N. J.

Enclosed find the Famous ALDRICH Boiler-Burner

• Always ahead in efficiency and economy, now the Gulf Stream is up to the minute in style, too. Choice of 5 sizes, with net ratings of 66,000 to 168,000 BTU per hour. Home owners have a choice—the space-saving "package" or standard model, with all controls and accessories easily accessible, or the Gulf Stream completely enclosed in a streamlined housing.

Ruggedly and simply built, the Gulf Stream picks up the heating load with immediate response. Special multiple-flue tube construction affords maximum heat extraction and quick transfer of heat to the boiler water.

With the tankless hot water coil added, the unit furnishes not only heat but hot water supply as well. Write for complete details.



Gulf Stream PACKAGE
Fully erected, pre-wired, accessory-equipped. Ready to set in place and connect. Easy to install and service.

GULF STREAM Standard
Comes fully erected, equipped with a complete set of automatic controls for 115 volt, 60 cycle operation, including thermostat, stack switch and limit control. Combustion chamber is installed. Top jacket removable without disconnecting water piping.

HOT WATER HEATERS
Internally galvanized, high delivery direct heating, no slow storage. **SERIES "B"**—93 to 850 GPH at 100° F. rise. **SERIES "C"**—100 to 255 GPH at 100° F. rise.

ANOTHER BREEZE MARK PRODUCT

ALDRICH COMPANY
105 WILLIAMS STREET • WYOMING, ILLINOIS
A SUBSIDIARY OF BREEZE CORPORATIONS, INC.

RECENT TRADE LITERATURE *(Continued)*

Internal Purifiers

An internal type purifier (scrubber) designed to deliver clean vapor and gases from steam drums, flash tanks, evaporators, packed towers, bubble cap towers, deodorizers and stills is described in a four page, two color bulletin. The folder contains dimensional drawings illustrating the use of purifiers in two typical installations. The V.D. Anderson Co., 1935 W. 96th St., Cleveland 2, Ohio.

Low Temperature Pipe Insulation

A four page folder on "Vapo-Wall", a low temperature pipe insulation, describes its insulating properties and gives recommendations on application. Insulation is made of Dow "Styrofoam." MMM, Inc., 7120 Avenue C, Houston, Tex.

Nickel Alloy Cast Irons

Manufacturer's bulletin A-115 contains 16 pages, 13 charts and 11 tables on how to increase the usefulness of cast irons and improve properties by alloying and heat treatment. A glossary of terms is included. The International Nickel Co., Inc., 67 Wall St., New York 5, N.Y.

Pumps for Cooling Towers

Illustrated literature on the manufacturer's series "1522" and "1531" centrifugal stock pumps for cooling tower or evaporative condenser application includes sizes, capacities and prices. Bell & Gossett Co., 8200 N. Austin Ave., Morton Grove, Ill.

Refrigeration Equipment

A catalog, designed as a quick reference source for the manufacturer's line of refrigeration products, contains photographs, dimensional tables, capacity ratings, shipping weight information, selection tables for high and low temperature applications, and other pertinent information. Kramer Trenton Co., N. Olden and Breunig Aves., Trenton 5, N.J.

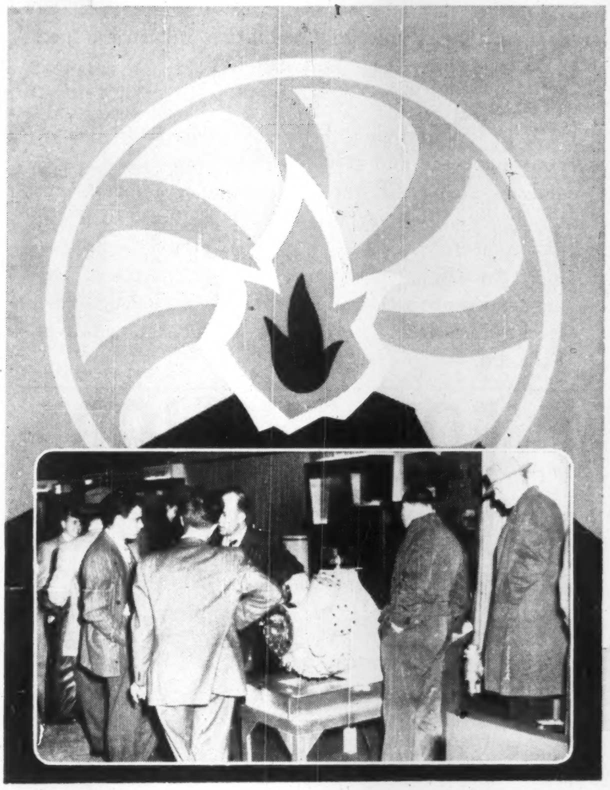
Shock and Vibration Isolators

An eight page booklet, bulletin No. 541, describes the features and uses of the manufacturer's type "5200" shock and high vibration isolators. Information is given on the load ranges of the mounts which are designed primarily as shock isolators for application in the marine, transportation and industrial fields. Graphs, specification data, etc., are included. The Barry Corp., 765 Pleasant St., Watertown, Mass.

Stainless Steel Piping

Data for engineers and designers associated with the problems involving stainless piping are included in a bulletin which outlines methods of bending and joining stainless pipe and discusses the problem of light wall versus heavy wall pipe. Included are a table of dimensions and weights of various pipe size

More than 2,000 answers to your heating, ventilating and air conditioning PROBLEMS



That's what you'll find at the 12th INTERNATIONAL HEATING and VENTILATING EXPOSITION where over 400 leading manufacturers will demonstrate more than 2,000 new and improved products. There'll be answers to your problems about conditioning air in commercial, industrial, public and domestic buildings.

See the latest developments in equipment, practices and materials on display in a 5-day concentrated effort to provide you with the best ideas for economical and efficient modernization.

12TH INTERNATIONAL HEATING & VENTILATING EXPOSITION

Air Conditioning Exposition

COMMERCIAL MUSEUM • PHILADELPHIA

JANUARY 24-28, 1955

PLAN NOW TO ATTEND

Look for your answers from exhibits, demonstrations, technically qualified personnel, comparisons of competitive products, on-the-spot cost estimates, available technical data — and in other time-saving, cost-saving ways.

Bring your associates to this source of quick and complete information.

Under the auspices of the American Society of Heating and Ventilating Engineers

Write for advance registration Management: International Exposition Co., 480 Lexington Ave., New York 17, N. Y.

RECENT TRADE LITERATURE *(Continued)*

schedules and technical data on mechanical and physical properties of the more popular stainless steels used for piping. Tubular Products Div., The Babcock & Wilcox Co., Beaver Falls, Pa.

Steam Traps

A steam trap with a solid stainless steel disc as its only moving part which operates as a valve head requires little maintenance due to its simplicity, its manufacturer reports. Bulletin 145 gives data on this and other of the company's line of traps. Sarco Co., Inc., Empire State Bldg., New York 1, N.Y.

V Belt Catalog

A v belt drive manual for use by design, purchasing, production and maintenance departments contains selection tables, drive design, data, information on sheaves and pulleys and v belts of several types, the manufacturer reports. T.B. Wood's Sons Co., 1275 Fifth Ave., Chambersburg, Pa.

Ventilating Equipment

A guide to selection of propeller fan type ventilating equipment is offered in a 36 page catalog. Specifications and other installation data are given on fans in portable, kitchen, tubeaxial, centrifugal, home cooling, roof ventilator and other types. Ilg Electric Ventilating Co., 2850 N. Pulaski Rd., Chicago 41, Ill.

Water Gages

Manufacturer's pressure sealed boiler water gage, equipped with type "M" illuminator that is designed to give brilliance to flat glass inserts and to spot the water level over its entire traverse, is discussed in bulletin WG-1812. Yarnall-Waring Co., Mermaid Lane, Philadelphia 18, Pa.

Water Tube Steam Generator

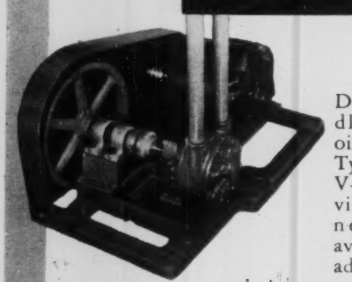
An illustrated eight page catalog gives data and dimensions and shows features of construction and operation of the manufacturer's water tube type "D" steam generator. Is cataloged in 17 sizes with capacities from 8,000 to 40,000 lb of steam per hr, the company says. Superior Combustion Industries, Inc., 1475 Broadway New York 36, N.Y.

Welding

A folder, outlining the welding characteristics of both austenitic and ferritic grades of stainless steels and discussing the question of proper joint design, briefly describes various welding methods such as: fusion, metallic arc, oxyacetylene, atomic hydrogen, inert gas arc and flash butt welding. A table of recommended arc welding procedures is included. Tubular Products Div., The Babcock & Wilcox Co., Beaver Falls, Pa.

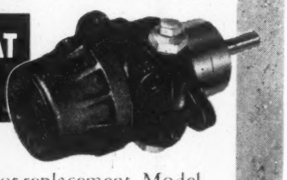
THE RIGHT PUMP FOR THE JOB

TUTHILL TYPE SU
for Industrial Heating



Designed to handle heavy fuel oils, the Tuthill Type SU multiple V-belt unit provides flexibility never before available. Typical advancements include one-point belt-tension adjustment; motors up to 5 h.p. mounted for easy adjustment or replacement without drilling or tapping; jack shaft supported by ball-bearing pillow blocks, carries weight of pulley and absorbs belt tension. For the complete story, write for Catalog No. 107.

TUTHILL 30A5G FUELSTAT
for Domestic Burners



For original equipment or replacement, Model 30A5G FUELSTAT offers many important advantages beyond traditional Tuthill quiet operation, leakfree performance and low power consumption. It is reversible in the field. It has a one-position vertical valve that can be piped from either side and serviced easily. Its mechanical seal is replaceable in the field. It is universally interchangeable with standard commercial models. It reduces pump inventory because the same pump can be used for both rotations and both valve positions. Write for Model 30A5G bulletin.

TUTHILL PUMPS FOR THE PURPOSE

TUTHILL PUMP COMPANY
Dependable Pumps since 1927
939 East 95th Street, Chicago 19, Illinois
Canadian Affiliate: Ingersoll Machine & Tool Co., Ltd.
Ingersoll, Ontario, Canada

A pipe dream come true!

Made in pre-formed sections, new Fiberglas Low Pressure Pipe Insulation is easily and economically applied. Comes in sizes to fit standard pipe up to 12", all copper tubing up to 3" in diameter. Suitable finishes, including vapor barrier jackets for cold line anti-sweat purposes, *are factory applied.*

New, rot-proof, shrink-proof, high thermal efficiency

FIBERGLAS* LOW PRESSURE PIPE INSULATION

for low pressure steam lines, hot and cold water lines!

The problem is solved—no more rotting, shrinking, adsorbent, *costly* insulation on your low pressure steam lines, your hot and cold water lines!

New Fiberglas Low Pressure Pipe Insulation is here—the first major improvement in low pressure pipe insulation in over 30 years—tested and proved in three years of trial applications!

Made of inert fibers of glass, this pipe dream come true will not rot, shrink, swell, buckle, or sag. It's lightweight, resilient, moisture resistant, *and up to 50% more efficient thermally than old insulations used in low pressure service.* Best of all . . .

New Fiberglas Low Pressure Pipe Insulation is priced right in line with ordinary insulations!

Which means that for a given installation it's actually cheaper. For thanks to higher efficiency, ½" of Fiberglas Low Pressure Pipe Insulation does the same insulating job on hot piping as 1" of less efficient old type insulation —and it lasts and lasts. The properly located vapor barrier (on outside of insulation) helps avoid condensation, adsorption and resultant corrosion of pipe and deterioration of insulation.

Whatever the application—low pressure steam, hot water or anti-sweat for cold water lines—Fiberglas Low Pressure Pipe Insulation pays for itself time and time again. Moreover, it's easy to cut and handle, fast and economical to install.

Mail coupon now for new 4-page bulletin giving full technical data!

OWENS-CORNING
FIBERGLAS
T.M. REG. U.S. PAT. OFF.

*T. M. Reg. U. S. Pat. Off.

PIPE INSULATIONS • ROOF INSULATIONS • DUCT INSULATIONS
EQUIPMENT INSULATIONS • LOW TEMPERATURE INSULATIONS

Owens-Corning Fiberglas Corporation
Dept. 40-L
Toledo 1, Ohio

Please send me a free copy of your new 4-page technical bulletin on new, rot-proof, shrink-proof, high efficiency Fiberglas Low Pressure Pipe Insulation.

Name..
Position..
Company..
Street...
City.................................**Zone**......**State**..........

WHO'S WHAT . . .

(New personnel, promotions)

▶ *BELL & GOSSETT CO.*—W. A. Boone, sales manager; A. B. Meeg, assistant sales manager; E. F. Ford, manager of national accounts; M. H. Hofmeister, manager of Original Equipment Sales Div.; C. L. Towns, manager of Heating Products Div.; H. H. Barclay, assistant manager of Industrial Products Div.

▶ *STOKER MANUFACTURER'S ASSN.*—Elected officers: L. C. Dubs, president reelected for a third term; R. F. Young, vice president; E. J. Worley, secretary-treasurer. All incumbents were reelected.

▶ *WM. STEINEN MFG. CO.*—Robert W. Hundley, sales manager, Accessories Div. He served previously as assistant sales manager.

▶ *STERLING ELECTRIC MOTORS, INC.*—Richard J. Zobel, Philadelphia district manager. Richard L. Bedell, Rochester branch manager.

▶ *ARMCO STEEL CORP.*—Henry L. Woods, Jr., director of sales planning. Mr. Woods was formerly assistant to the president of the corporation.

▶ *DE LAVAL STEAM TURBINE CO.*—Harry Engvall, executive engineer; John S. Haverstick, chief engineer of the turbine and gear departments.

▶ *DELAVAN MFG. CO.*—Ray J. Slezak, sales engineer; Robert Keene, sales promotion manager.

▶ *QUIET HEET MFG. CORP.*, subsidiary of *EMERSON RADIO AND PHONOGRAPH CORP.*—John D. Small, president; Bruno Sachs, vice president and assistant to the president; Louis G. Pacent, Jr., vice president in charge of manufacturing; Paul Komroff, vice president in charge of engineering; Raymond Herzog, secretary.

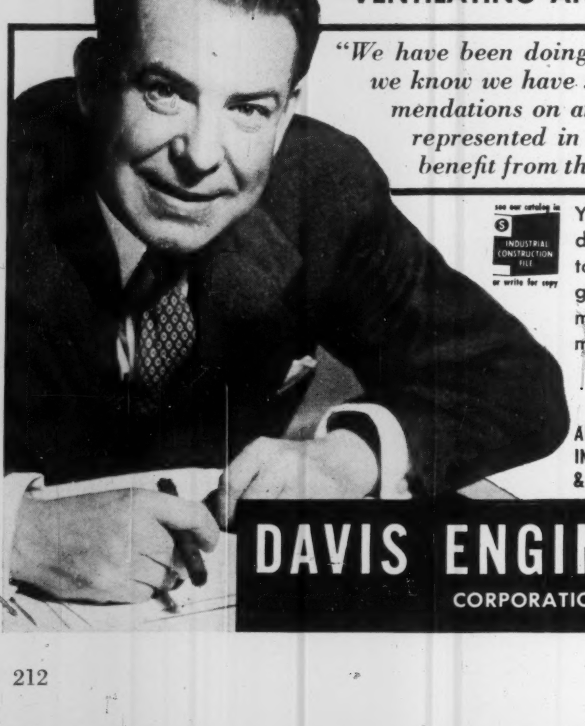
▶ *TURBINE EQUIPMENT CO.*—Harold Sinclair, chairman of the board; Donald F. Miller, president; Paul E. Linthiwaite, vice president in charge of machinery sales.

▶ *UNION ASBESTOS & RUBBER CO.*—Charles B. Bendix, manager of contract sales.

▶ *WARREN WEBSTER & CO.*—A. Richard Webster, vice president in charge of engineering and production, secretary of the management committee and chairman of the plant committee.

By all means . . . check with Paracoil

before you place that order for INDUSTRIAL HEATING, COOLING, VENTILATING AND PROCESS HEAT EXCHANGER EQUIPMENT



"We have been doing just that for over a quarter of a century—and we know we have saved ourselves thousands by taking their recommendations on any problem involving heat exchangers. They are represented in all principal trading areas, too, so you also can benefit from their experience, just as we have through the years."

see our catalog in
S
INDUSTRIAL CONSTRUCTION FILE
or write for copy

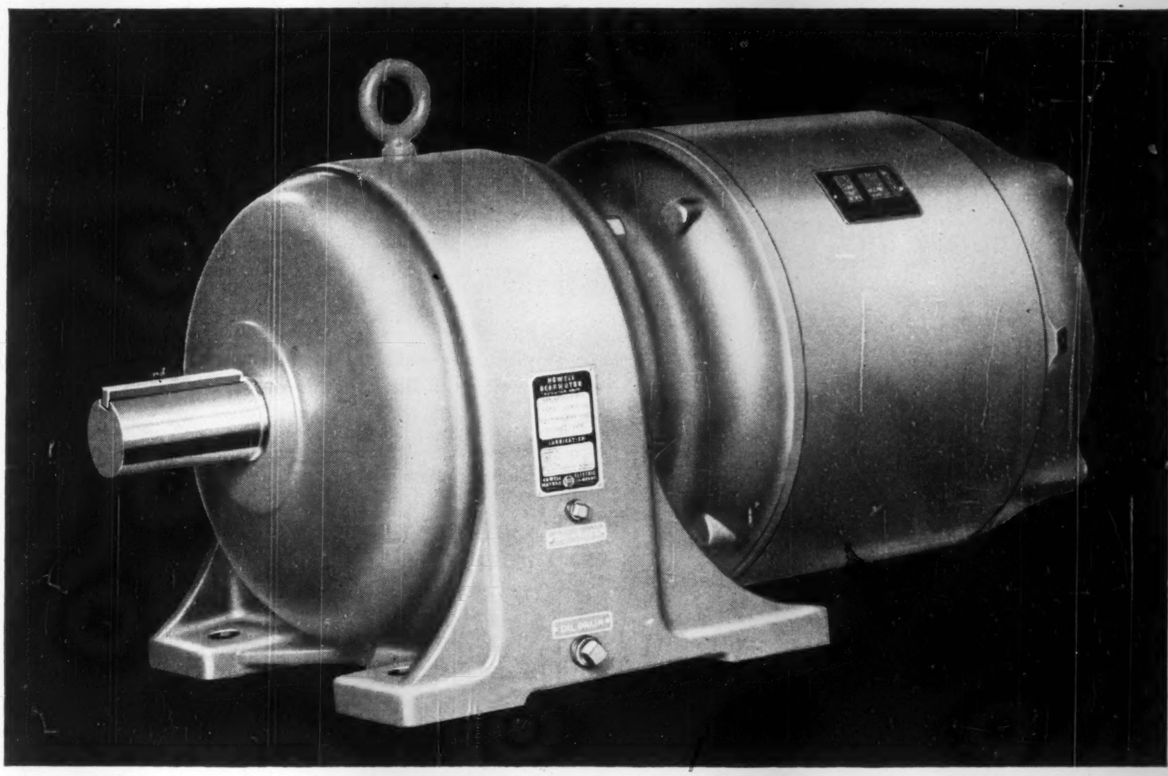
You are so correct, Mr. PARACOIL CUSTOMER. Whenever well designed and well built heat exchangers — adequately engineered to give customer satisfaction year after year — are being investigated, the smart buyer has always preferred PARACOIL equipment! They always have had that *extra something* that made them more than just an assembly of tubes inside of a shell!

Paracoil Heat Exchangers for the heating, piping and air conditioning contractor include:

AIR HEATERS & COOLERS · CONDENSATE COOLERS · CONVERTORS · FUEL OIL HEATERS INSTANTANEOUS WATER HEATERS · LAUNDRY HEAT RECLAIMERS · LUBE OIL HEATERS & COOLERS · TANK STORAGE TYPE WATER HEATERS · WASTE HEAT EXCHANGERS

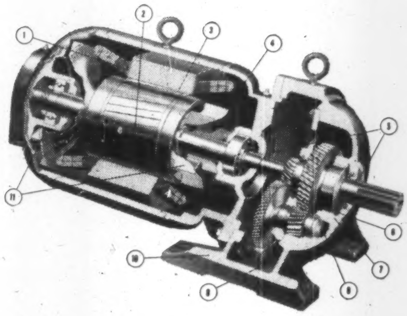
DAVIS ENGINEERING
CORPORATION

1064 East Grand St., Elizabeth, New Jersey
30 Rockefeller Plaza, New York 20, N. Y.
Write for catalog information



The power you need at the speed you need it . . .

HOWELL GEAR MOTORS



11 reasons why Howell Gear Motors last longer, serve you better

1. High-quality insulation
2. Copper-clad rotor
3. Expert craftsmanship
4. High-quality coil varnish
5. Leakproof oil seals
6. Duti-Rated Lifetime Gearing
7. Unit case construction with integral bearing housings
8. Corner-mounted offset shaft
9. Large oil reservoir
10. Heavy, cast-iron construction
11. Superior cooling

New dependability, greater starting torque and top efficiency, with output speeds as low as 7.5 rpm. are now available in Howell Gear Motors.

This compact, single-unit motor may well be the answer to your gear reduction problems. Combining the finest in heavy duty industrial gearing with the best in motoring, Howell Gear Motors reduce drive failures and production downtime.

Howell Gear Motors use duti-rated, lifetime gearing, with file-hard tooth surfaces and tough, resilient cores. They are available in all types of enclosures, from 7.5 to 780 rpm. with a capacity range from 1 to 150 hp., in all three AGMA service classifications.

For full information on Howell Gear Motors, contact the Howell man in your area, or write the factory direct for Bulletin GM-1.

HOWELL Red Band MOTORS

HOWELL MOTORS

HOWELL ELECTRIC MOTORS COMPANY, HOWELL, MICHIGAN

MOTORS FOR INDUSTRY SINCE 1915

Do you KNOW your STEAM COSTS?

Whether you burn coal, oil or gas you can quickly and easily determine your steam cost per horse power with this handy, pocket-size Dutton STEAM COST CALCULATOR. It also enables you to check the efficiency and fuel cost of your boiler with those of Dutton EconoTHERM, EconoMIST and EconoMIZER package Boilers — famous for efficiency, long life, low operating costs.

Dutton
Steam Cost Calculator
COAL
GAS
OIL
KALAMAZOO, MICHIGAN

Send for your FREE DUTTON STEAM COST CALCULATOR — Do It Today!

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DIVISION
HAPMAN-DUTTON COMPANY
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KALAMAZOO, MICH. BOILER BUILDERS SINCE 1880

Send Me FREE Steam Cost Calculator

Name..........

Title..........

Company..........

Street Address..........

City..........

WHO'S WHAT

Continued

▶ *FRIGIDAIRE DIV., GENERAL MOTORS CORP.* —R. E. Gould, assistant chief engineer in charge of research and future products division; W. H. Anderson, assistant general sales manager; W. F. Switzer, merchandising manager of appliance sales; L. W. Smith, commercial and air conditioning sales manager; R. L. De Marse, Dayton sales branch manager.

▶ *FLEXONICS CORP.*—Frank C. Hesterman, technical staff assistant in production; E. L. Hiter, sales manager of the Expansion Joint Div.

▶ *FLEXIBLE TUBING CORP.*—Frederick Ross Black, industrial engineer.

▶ *GARDNER-DENVER CO.*— A. G. Lindquist, vice president. Mr. Lindquist will continue as secretary and comptroller in addition to his new duties.

▶ *BLACKMER PUMP CO.*—Robert P. Cutting, manager of Newark district.

▶ *BEAVER PIPE TOOLS, INC.*— Russell Herig, field sales manager.

▶ *COMBUSTION ENGINEERING, INC.*— Broderick Haskell, a director of the Atomic Industrial Forum.

▶ *AMERICAN RADIATOR & STANDARD SANITARY CORP.*— Daniel J. Quinn, vice president in charge of sales of the Plumbing and Radiator Heating Div.

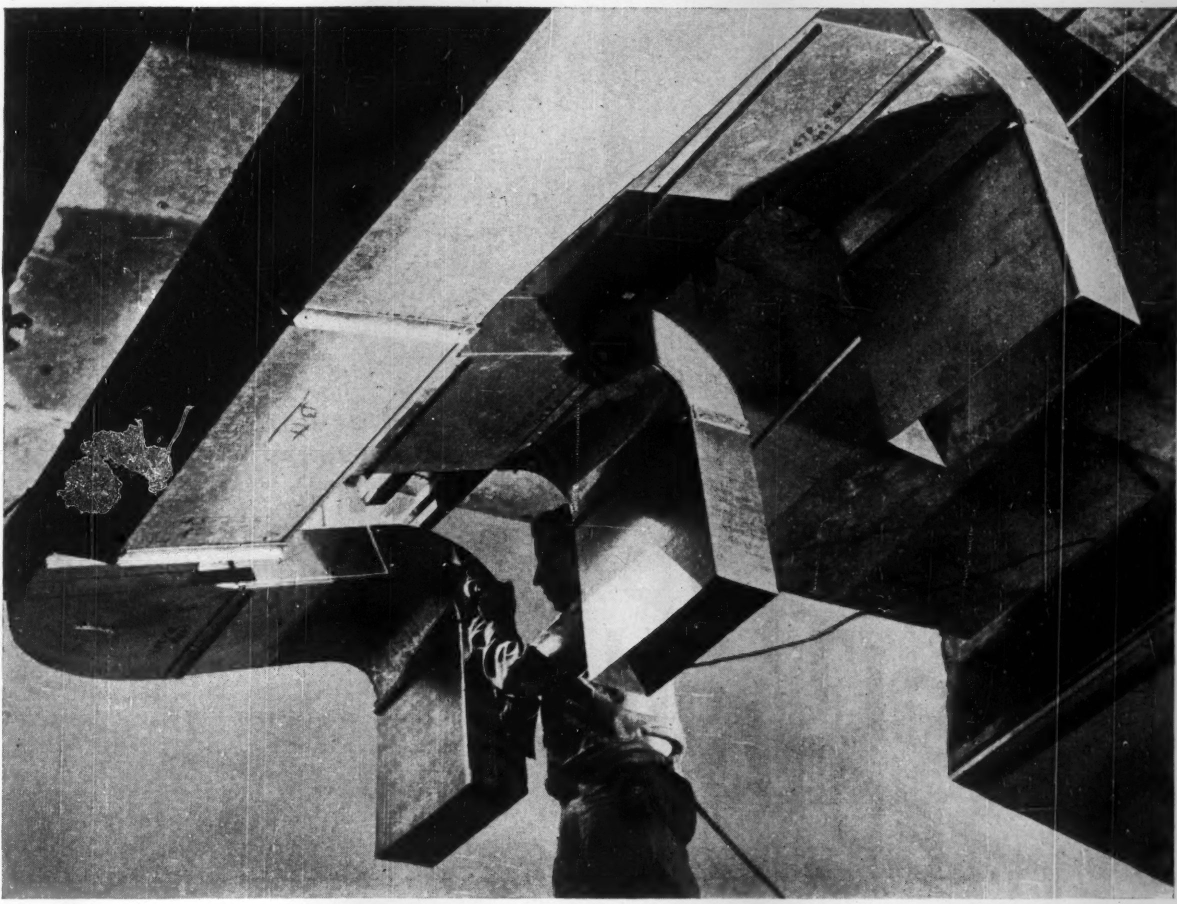
▶ *AMERICAN GAS ASSN.*—Russell Griffith, research engineer.

▶ *TYPHOON AIR CONDITIONING CO., INC.*— A. G. Masiello, assistant sales manager.

▶ *PERFEX CORP.*—Harold Wellnitz, national director of service education. Requests for service school information should be sent to Mr. Wellnitz, Perfex Corp., 500 W. Oklahoma Ave., Milwaukee 7, Wis.

▶ *RAYTHEON MFG. CO.*—Hubert Sear, Jr., M. D., engineer in the medical products laboratory. He will assist in the application and promotion of diathermy equipment and the "Micronaire" room air cleaner, and in designing new products for the medical field.

▶ *PENN CONTROLS, INC.*—George S. Myers, director of manufacturing.



For Looks, Long Life, Low Cost

Make it with Galvanized Steel

Your sheet-metal jobs have real sales appeal when you work with Bethlehem galvanized steel sheets. Those thousands of gleaming spangles give a clean, bright appearance that pleases the eye and reflects your excellent workmanship.

Bethlehem galvanized sheets make your ductwork long-lasting. The tight coat of rust-resisting zinc will stand off the attacks of corrosion for many years to come.

Low cost is another advantage of Bethlehem galvanized steel sheets. Being stronger than other commonly-used sheet metals, galvanized steel can be used in the lighter, less expensive gages. Pound for pound, no other sheet metal can match the low cost of steel.

Bethlehem galvanized sheets, including plain and copper-bearing as well as Bethcon continuously galvanized sheets, are made from durable, open-hearth steel, cold-rolled uniform to gage. They are flat, ductile, easy to work. They'll help you turn out a top-notch job that is sure to please the customer every time.

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

Bethlehem *GALVANIZED* Steel Sheets

BETHLEHEM STEEL

POSITIVE PROTECTION

For Underground Insulated Piping

Universal Vitrified Tile Conduit

is resistant to disintegrating action of electrolysis, water, acids, alkalies, rust and other corrosive elements.

Universal Conduit and Base Drains are manufactured of hard surface salt-glazed vitrified tile to A.S.T.M. Standards.

The special Universal feature — interlocking construction and continuous Key-Lock side joints — assures a complete assembly of all parts into a rigid, watertight whole.

TWO STYLES

STANDARD for use in average ground loads.
SUPER for heavy ground loads.
Easy Installation. Write for Catalog No. 54

Now Sold Exclusively through your
MUNDET Cork Corporation—Distributors

UNIVERSAL SEWER PIPE CORPORATION
Steam Conduit Division
1500 UNION COMMERCE BLDG. • CLEVELAND 14, OHIO

WHO'S WHAT

Continued

▶ *H. D. CONKEY & CO.*—R. A. Hossinger and H. J. Kettleborough, vice presidents; H. B. Goebel, treasurer.

▶ *CORY CORP.*—Lyle R. Cazel, manager of advertising and publicity.

▶ *COOPER ALLOY CORP.*—Peter Gasperini, sales department of the Valve & Fittings Div.

▶ *CHRYSLER CORP., AIRTEMP DIV.*—S. R. Prugh, assistant sales manager in charge of room air conditioners; F. J. Laughna, administrative manager in charge of sales records, products order, parts order and statistical departments; H. R. Dillon, supervisor of room air conditioner sales.

▶ *MORSE CHAIN CO.*, a Borg-Warner subsidiary—Louis Paul Smith, vice president of manufacturing operations; M. V. Bailliere, responsible for finances; Norman C. Bremer, chief engineer at both the Ithaca, N. Y. and Detroit plants; James V. Davis, industrial relations manager of both plants.

▶ *BINKS MFG. CO.*—B. J. Hedger, national sales manager of Industrial Div.

▶ *A. M. BYERS CO.*—Frank L. Seamans, a director; John J. Sayles, field service engineer in Cleveland area.

▶ *BRYANT HEATER DIV., AFFILIATED GAS EQUIPMENT, INC.*—Philip C. Kosch, manager of sales training.

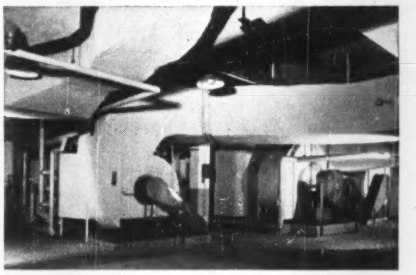
▶ *WESTERN ENGINEERING & MFG. CO.*—Ernest W. Smith, manager of Los Angeles sales division, *VENTILATING EQUIPMENT CO.*

▶ *YOUNGSTOWN SHEET & TUBE CO.*—Herman J. Spoerer, vice president for industry and chairman of the Industrial Conference at the 42nd annual congress of the National Safety Council; John M. Tuthill, general manager of sales for the company; P. G. Boyd, western manager of sales.

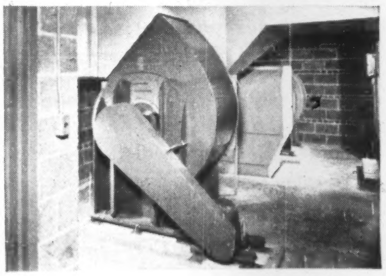
▶ *YARNALL-WARING CO.*—John A. Steer, sales manager of the Boiler Trim Div.

▶ *AMERICAN COILS CO.*—C. M. Hatcher, general sales manager.

OAKWOOD HOSPITAL—Architects: Stanton & Hillier. Consulting Engineer: George Wagschal Associates. Building Contractor: W. E. Wood Company. Heating Contractor: Page Plumbing and Heating Company.



American Blower primary and secondary fans supply heated air to rooms, offices, dining room, kitchen and corridors. Surgery, with its precise requirements for specially conditioned air, also depends on American Blower equipment. The kitchen unit relies on an American Blower sprayed coil dehumidifier.



Proper balance of air between supply and exhaust is air handling equipment's biggest job. Oakland Hospital used a total of 10 American Blower HS fans (two are shown here) to handle air exhaust.

"Ventilation was a major factor in planning for the health and comfort of our patients"

—FRED BECHTOL, BUILDING SUPERINTENDENT, OAKWOOD HOSPITAL

Air handling equipment in a modern hospital must be dependable and quiet in operation. The health and comfort of the patients demand it. At Oakwood Hospital, $5 million medical center in Dearborn, Michigan, American Blower air handling equipment was specified.

Fred Bechtol, Building Superintendent, appreciates the way American Blower equipment is built to run continuously at rated capacities, with no breakdowns and minimum maintenance expense. American Blower engineers welcome the opportunity to cooperate with you. If you have an air handling problem, give your nearest American Blower or Canadian Sirocco Office a call.

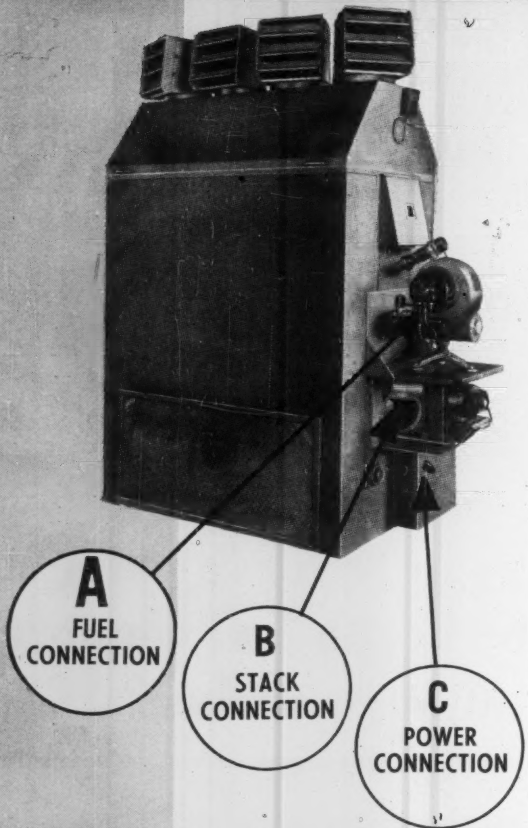
AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO
Division of American Radiator & Standard Sanitary Corporation

★ **See American Blower's new products!**
★ **Visit the American Blower exhibit**
International Exposition JAN. 24-28
Philadelphia **Don't miss it!**

AMERICAN BLOWER

Serving home and industry: AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS & WALL TILE • DETROIT CONTROLS • KEWANEE BOILERS • ROSS EXCHANGERS • SUNBEAM AIR CONDITIONERS

A-B-C-Installation



THREE SIMPLE STEPS

An Olson installation requires only the connection of fuel supply, connection to power line, connection to exhaust stock and it's ready for automatic operation—unattended. A self-contained stainless steel combustion chamber eliminates the costly, time-consuming task of refractory lining. Greatest of all, the initial cost is so much lower than other types of heating. These attractive installation features are made possible because Olson Heaters are completely factory-assembled by the same expert craftsmen who build them. It comes to you as a complete self-contained unit, preflame-tested, pre-regulated, ready to start a long life of smooth heating service for its owner.

Write for Bulletin AIA—Detailed, Illustrated

Olson

ARTHUR A. OLSON & CO., CANFIELD, OHIO
REPRESENTATIVES IN PRINCIPAL CITIES

HEATERS FOR GAS, OIL COAL OR DUAL GAS AND OIL.

WHO'S WHAT

Continued

▶ *INSTRUMENT SOCIETY OF AMERICA*—Warren H. Brand, president; A. A. Anderson and W. H. Fortney, vice presidents; Justus T. Vollbrecht, second term as treasurer.

▶ *MINNEAPOLIS-HONEYWELL REGULATOR CO.* — Harold W. Sweatt, special consultant to the Foreign Operations Administration to assist in Europe; Marshall B. Taft, general manager of the Valve Div.; Ralph A. Rockwell, chief engineer for the Valve Div.; F. M. Thuney, manager of the contract division in the Industrial Div. plant in Philadelphia; J. W. Bowers, manager of the department of service and repair of controls for commercial establishments.

Other appointments are: Harry E. Grossman, Washington branch manager; Joseph H. Nixon, charge of Grand Rapids district office; Wayne F. Kelly, manager of Spokane branch; T. S. Bolling, Charleston, W. Va. district office; Charles W. Prey, Harrisburg district office; Leight M. Johnson, commercial sales manager in Harrisburg; Raymond A. Metz, senior commercial salesman in Philadelphia.

▶ *KIELEY & MUELLER, INC.*—Norman Lieblich, vice president. Mr. Lieblich was formerly general sales manager.

▶ *OHIO INJECTOR CO.*—Verland W. Belt, general superintendent; Norman A. Malone, chief manufacturing engineer; Harry C. Bell, director of engineering; A. A. Kruse, Jr., chief engineer.

▶ *PLUMBING AND HEATING INDUSTRIES BUREAU*—Elected officers: John H. Ewald, president; W. O. Brown, vice president; George O. Toepfer, treasurer; Norman J. Radder, secretary.

▶ *PRECISION THERMOMETER & INSTRUMENT CO.*— George M. Cleary, chief engineer; Harry F. Ogden, Jr., sales manager.

▶ *GENERAL CONTROLS CO.*—John A. Wolff, sales manager of Heating Controls Div.

▶ *HOOKER ELECTROCHEMICAL CO.*—James F. Lemen and Gordon D. Sargent, chemical engineers in the process study group; Dr. Edward Leon, and John J. Wojnar, chemists in the research and development department; Myron C. Hall, chemical engineer in the engineering department.

▶ *SWARTWOUT CO.*—Alfred H. Mansbach, chief engineer.

WHO'S WHAT

Continued

▶ *ANACONDA WIRE & CABLE CO.*—David C. Allen, vice president in charge of sales; Charles H. Porter and Maurice J. McCarthy, commercial vice presidents. Mr. Allen has appointed H. V. Van Valkenburg, sales manager; C. B. Peck Jr., manager of industrial sales; J. L. Tindale, manager of utility sales; H. E. West, manager of contractor sales; Dan Mancini, administrative assistant; Ernest B. Miller, Jr., manager for the Chicago sales district; John N. Ratcliff, Jr., manager for Houston sales district.

▶ *AMERICAN WELDING SOCIETY*— Joseph H. Humberstone, president. Mr. Humberstone is president of Air Reduction Sales Co., Inc.

▶ *ARMCO STEEL CORP.*— R. L. Gray, executive vice president; H. H. Tullis and R. S. Gruver, administrative vice presidents; John W. Anderson, president of company's Sheffield Steel Div.

▶ *INTERNATIONAL NICKEL CO., INC.*—William H. Sparr, Jr., charge of the Steel Section of Nickel Sales Dept. in New York; C. T. Haller, Jr., charge of the Technical Field Section of the Development and Research Div. in Pittsburgh, George L. Hoobler, Technical Field Section.

▶ *JOSEPH T. RYERSON & SON, INC.*—Melvin B. Monson, Milwaukee plant manager. He succeeds Fred Kurfess, retired.

▶ *RCA HOME APPLIANCE DIV.*—John W. Craig, vice president and general manager. Mr. Craig will supervise the air conditioning department.

▶ *STAR EXPANSION BOLT CO., INC.*—Harry Fox, vice president in charge of sales for the company and its affiliates.

▶ *STERLING ELECTRIC MOTORS, INC.*—John R. Howell, sales manager and director.

▶ *TURNER CONSTRUCTION CO.*—Clinton N. Hernandez, vice president.

▶ *TRANE CO.*—George C. Wilson, assistant development engineer in the engineering department, heat transfer section.

▶ *WESTINGHOUSE ELECTRIC CORP.*—Dr. W. H. Brandt, manager, new products engineering department; Walter T. Rogers, manager of advertising and sales promotion for the Sturtevant Div.

For all-around utility...
the BEST BUY is Ramset
FASTENING SYSTEM

SUPER-POWER JOBMASTER
for heavy-duty work
Operating length 15" Weight 7⅞ lbs.

TWO TOOLS IN ONE
JOBMASTER and PLUS-POWER JOBMASTER
Length 12"
Weight 6¾ lbs.

Ramset Fasteners
Ramset Fasteners
3/8" Fasteners
1/4" OR 3/8" Fasteners

For your light-duty anchoring work into steel or concrete, requiring ¼" fasteners, the Ramset Jobmaster can't be matched for speed, ease, economy and wide versatility.

If ⅜" fasteners are called for, you can have a Plus-Power Jobmaster, or attach a ⅜" assembly to your standard Jobmaster. You can interchange from one to the other in a few moments. Thus you have two tools for slightly more than the cost of one, to set either ¼" or ⅜" fasteners.

Where heavy-duty ⅜" fasteners are needed, the great driving power of the new Super-Power Jobmaster sets them instantly into 1" mild steel or into the hardest concrete.

Write us or ask your Ramset dealer for on-your-job demonstration of the all-around superiority of Ramset System for ease, speed, utility and economy.

Ramset Fasteners, INC. RAMSET DIVISION, OLIN INDUSTRIES, INC.
12109 BEREA ROAD • CLEVELAND 11, OHIO

FIRST IN POWDER ACTUATED FASTENING
AN Olin PRODUCT

WHO'S WHAT

Continued

IN THE TERRITORIES . . .

(Recent sales appointments)

▶ *RELIANCE ELECTRIC & ENGINEERING CO.*—Vernon S. Barnes, branch manager for new direct factory sales office in Milwaukee; Peterson Nesbit and Albo D. Bua, application engineers, New York and Newark sales offices; Charles F. Carnish, district sales engineer in Detroit area.

▶ *HAMER VALVES, INC.*—Tom S. Andrews, New Mexico, Arkansas and Louisiana. Previously he represented the company only in Oklahoma. The Ralph Stockton Co., handling valve sales in southern Texas.

▶ *TYPHOON AIR CONDITIONING CO., INC.*—Maurice Firestone, regional sales director for New York metropolitan area; Melvin Klingher, district sales manager for northern New Jersey and Staten Island. New York City appointments are: Seymour Jarcho, Manhattan, Bronx and Westchester; Donald J. Dailey; handling national accounts with headquarters in New York.

▶ *TUBE TURNS*—Pacific Metal Co., distributor for aluminum welding fittings and flanges in Portland, Oregon area.

▶ *BLACKMER PUMP CO.*—Richard L. White, manager of Philadelphia district office; John D. Fansler, manager of North Central division (Illinois, Indiana, Wisconsin, Iowa, Missouri, Minnesota, Nebraska, North and South Dakota); Henry E. Graper, manager of Ohio Valley district (Ohio, Kentucky and West Virginia.)

▶ *BRUNER CORP.*—W. C. Patterson, district sales manager for Northern California.

▶ *BABCOCK & WILCOX CO.*—Ray E. Fleeson, sales staff of Chicago district office of Tubular Products Div.

▶ *COPELAND REFRIGERATION CORP.*—Noland Co., Inc.'s branches in Newport News and Norfolk, Va.; Climate Supply Co., Dallas.

▶ *MARLO COIL CO.*—southern representative, Engineering Sales Co. of New Orleans, new offices in Baton Rouge and Jackson, Miss.

▶ *DRAYER-HANSON, INC.*—Homer G. Maxey & Co., Inc., representative in part of New Mexico and Texas Panhandle area.

FUEL SAVINGS — $1000 per YEAR

with Perfex Controls!

PERFEX
CONTROLS
YOU CAN TRUST

PERFEX CORPORATION, MILWAUKEE, WISCONSIN
In Canada, Perfex Controls Ltd., Toronto 1, Canada

"Perfex Controls and Instruments installed in our boiler room saved over $1000 per year—In their first year of operation the savings were more than sufficient to pay for the installation." Joseph G. Norby, Administrator of Columbia Hospital, Milwaukee, Wisconsin.

CONSERVE FUEL • INCREASE EFFICIENCY
SAVE TIME • SAVE MONEY!

WITHOUT OBLIGATION
CLIP AND MAIL TODAY!

PERFEX CORPORATION
500 West Oklahoma Avenue
Milwaukee 7, Wisconsin
Send me more information on Perfex equipment for my boiler room.

Name____________________
Address__________________
City_____________________
State____________________

▶ *GLASS FIBERS, INC.*—Claredon, Inc., Detroit area distributor.

▶ *HOSE ACCESSORIES CO.*—Durrie Sales Co., representative in Illinois, Indiana and Iowa.

▶ *AMERICAN GILSONITE CO.*—Freemire & Associates, Inc., handling "Gilsulate" in the Baltimore-Washington district.

▶ *AMERICAN WATER SOFTENER CO.*—Piepenbrink Engineering Co., midwestern representative covering Iowa, Wisconsin, northern Illinois and northern Indiana.

▶ *AMANA REFRIGERATION, INC.*—Brown Supply Co., St. Louis area, and Major Appliance Co., central Michigan, distributing room air conditioners.

▶ *BENJAMIN ELECTRIC ,MFG. CO.*—Oliver C. Westberg, Pacific Coast division manager. The division has been divided into three districts—southern, northern and central—headed by G. A. Hochenauer, Los Angeles, Henry Huber, Seattle and John Keyes, San Francisco.

▶ *KRITZER RADIANT COILS*—Thermal Engineering Co., representative in Utah and Idaho with offices in Salt Lake City and Boise.

▶ *LINCOLN ELECTRIC CO.*—Robert J. Hirsch, district sales manager for arc welding machines and electrodes in Connecticut.

▶ *MITCHELL MFG. CO.*—J. H. Davidson, district manager of New York, New Jersey and Connecticut area; D. B. Jones, a similar post in southern New Jersey, eastern and central Pennsylvania, Maryland and Washington, D. C.

▶ *MINNEAPOLIS-HONEYWELL REGULATOR CO.*—Robert G. Hoch, sales and service manager of New York region for aeronautical division; Gerald G. Walker, Jr., branch manager of Buffalo sales office.

▶ *WESTINGHOUSE ELECTRIC CORP.*—James E. Reynolds, manager of new central district which includes Ohio, Kentucky, West Virginia, western Pennsylvania, most of Michigan and parts of Maryland and Indiana.

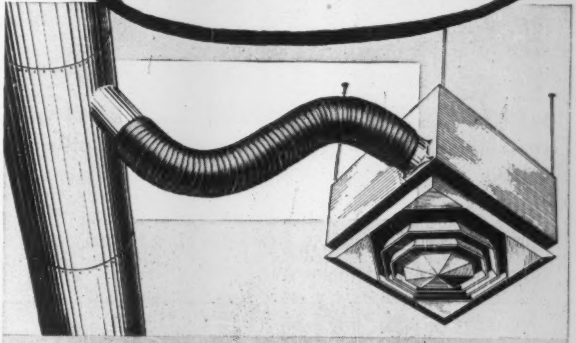
✓ SPECIFY

WIREMOLD

FLEXIBLE

AIR-DUCT

for Commercial Air Conditioning systems

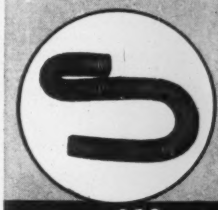


✓ EASY to INSTALL!
✓ SAVES Time and Money!
✓ INCREASES Efficiency!

The flexibility and lightness of WIREMOLD Flexible AIR DUCT save time and money on installation. It can be cut to length easily and quickly. All sizes are produced within exact tolerances, assuring a snug fit.

Wiremold's combination of tested materials and exclusive construction assures long life. There is no glue or adhesive to dry out or crack, because a specially coated Fibreglas is *mechanically locked* into the supporting steel spiral.

WIREMOLD AIR DUCT type 571A was developed specifically for flexible connections on high velocity systems. It provides an airtight connection which dampens mechanical vibration and allows for expansion and contraction.



WIREMOLD Flexible AIR DUCT has been tested in the laboratory and proved on the job. It is recommended by leading makers of air distribution equipment.

Get the complete story on WIREMOLD Flexible AIR DUCT. Write for Data Sheet S-3.

The WIREMOLD Company
HARTFORD 10, CONNECTICUT

WHO'S WHAT

Continued

▶ *CONTROLS AND INSTRUMENTATION SALES CO., INC.*—sales agent for instrument manufacturers in eastern Pennsylvania, southern New Jersey and New Castle County, Delaware.

▶ *CHRYSLER CORP., AIRTEMP DIV.*—Milton P. Veith, sales manager in Detroit area; Warren Fitch succeeds Mr. Veith in New Orleans territory.

▶ *DETROIT CONTROLS CORP.*—Raymond W. Lawton, representative in the Gulf states.

▶ *E. I. DU PONT DE NEMOURS & CO.*—offices in Chicago and Los Angeles to handle sales of "Freon" fluorinated hydrocarbon refrigerants and aerosol propellents. Norman W. Kent will supervise the Chicago office.

▶ *McQUAY, INC.*—John Mucha, heating and air conditioning products sales representative in northern Illinois and southern Wisconsin.

▶ *NATIONAL SUPPLY CO*—David A. Hess, sales representative in Pittsburgh.

▶ *MILLER VALVE CO., INC.*—Representatives: Eastern Steam Specialties Co., New York; Park S. Hedley Co., Inc., Buffalo; Bogart Co., Los Angeles; Ralph S. Beeson, Kansas City; Covan Co., Detroit; Eastman Coward Co., Philadelphia; Russell R. MacDonald Co., Richmond; McJunkin Corp., Charleston, W. Va.; S. F. Patterson, Seattle; Tyler-Dawson Co., Tulsa; John L. Underwood Co., Inc., Atlanta.

▶ *WARREN WEBSTER & CO.*—Bryan R. West, district representative for Washington, D. C. territory.

▶ *WOLVERINE TUBE, DIV. OF CALUMET & HECLA, INC.*—Harry L. Simcox, sales representative, servicing industrial accounts only, in southern Ohio and parts of Kentucky and Indiana; Ralph Julin, to contact wholesalers only in greater Chicago. Other appointments are: Edgar K. Schutz, Chicago; Robert Allan, Kansas City; Thomas E. Goodyear, Moline, Illinois.

▶ *RESEARCH PRODUCTS CORP.*—Luther B. Sovde, district sales manager for New York state, excluding the New York City area.

▶ *PERFECTION STOVE CO.*—E. J. McGrannahan, room air conditioner sales in Kansas City.

Where the problem is ventilation — the solution is a **WESTERN SYSTEM**

AT NORTHROP AIRCRAFT INC.

Problem: The Anaheim, Calif. Division of Northrop Aircraft, Inc. manufactures optical range finders and other ground weapon fire control devices for U.S. Army Ordnance. Dust-free ventilation a must! Solution: 38-30" Western Rotaries with Westernaire Curb-Mounted fans exhaust 18 million cubic feet of air per hour from the 250,000 sq. ft. building.

AT YOUR PLANT

Western Rotary ventilators, with or without fans, can do the most for you. A 2 mph wind operates the Western Rotary—and it continues to exhaust during wind lulls due to superior balance design. Years of trouble-free performance—bearings carry lifetime guarantee. Check Sweet's or AEC for high exhaust capacity figures. Then specify Western—a first-rate line of rotary, stationary, continuous ridge, directional ventilators and exhaust fans. Handled by wholesalers coast to coast.

Western Engineering & Mfg. Co.
4118 OCEAN PARK AVE. • VENICE • CALIF.

Dealers—order from your local jobber.
Write for catalog, or tell us your special installation problems.

WHO'S WHAT

Continued

▶ *WM. STEINEN MFG. CO.*—John B. Anderson, Engineered Products Co., representative in Kentucky and Tennessee in addition to Ohio and Indiana. Other distributors are: Ben D. Waller, Alabama, Georgia and South Carolina; Howard A. Weller Co., Oregon, Washington, Idaho and Montana and British Columbia and Alberta in Canada; Frank Harbin, Maryland, Virginia, North Carolina and part of Delaware; B. L. Rushton, Inc., western Pennsylvania and West Virginia; Imperial Refractories, all of Canada except B. C. and Alberta.

▶ *HEIL CO.*—Dygert Sales Co., Grand Rapids, Michigan area and Engineering Specialty Co., Gary, Indiana territory, distributing heating and air conditioning equipment.

▶ *INLAND STEEL PRODUCTS CO.*—Albert A. Miskulin, sales representative in northern Illinois.

▶ *INSUL-MASTIC CORP. OF AMERICA*—Carter-Bearden Co., representative in the Atlanta area.

▶ *JOHNSON & CHURCH CO.*—W. A. Case & Son Mfg. Co., stocking distributor in New York state.

▶ *KRAMER TRENTON CO.*—William J. Donovan, New England sales representative.

▶ *SERVEL, INC.*—National Airco Co., Inc., air conditioning distributors for seven counties in northern Maryland.

▶ *STEDCO PRODUCTS CO.*—J. Harry Riley, representative for "Hi-Therm Radiation" in northern New Jersey.

▶ *SPORLAN VALVE CO.*—R. H. Parlin and J. J. Mays, managers of Detroit and Dallas sales offices.

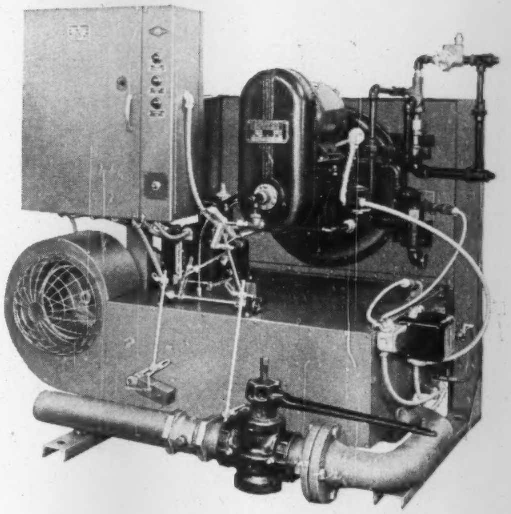
▶ *J. P. STEVENS & CO., INC.*—Kirby Industries, national sales agents for industrial glass fiber fabrics.

▶ *ELECTRO DYNAMIC DIV., GENERAL DYNAMICS CORP.*—Climax Services Co., to handle sales and services of motors and generators in Colorado.

▶ *GENERAL ELECTRIC CO.*—Cupp. Inc., Ft. Wayne and H. C. Gammon Co., Inc., Indianapolis, distributing "Weathertron."

▶ *WINDMASTER CORP.*—Morris Chapman, sales representative in New England territory.

WEBSTER
ROTONETIC*



DUAL FUEL FIRING BURNER

- √ Sizes from 75 to 300 horsepower.
- √ Minimum gas pressure requirements.
- √ Low installation costs.
- √ Maximum efficiencies on BOTH gas and oil.
- √ Minimum base height requirements.
- √ Utilizes all grades of fuel oil.
- √ Extremely low noise level.
- √ Approved electronic combustion safeguard system.
- √ Simpler changeover than ever before.
- √ One hundred per cent forced draft.
- √ Completely assembled, piped, wired and tested.

These and many other outstanding features combine to provide the same dependable high quality performance as the WEBSTER DYNETIC gas burner. Neither fuel must suffer if the WEBSTER ROTONETIC is used. With integral pumps, integral oil preheaters for heavy oils, patented oil burner "flame-shaping" vanes, and full modulating or optional high-low control, the WEBSTER ROTONETIC is designed to provide long lasting customer satisfaction the year around.

It is furnished with a precast refractory front as an integral part of the burner assembly. The installer need only finish the furnace wall on each side and above the burner.

Listed by Underwriters' Laboratories, Inc.

*TRADEMARK

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The WEBSTER ENGINEERING COMPANY
TULSA, OKLAHOMA
Division of SURFACE COMBUSTION CORPORATION, Toledo, Ohio

read low surface temperatures in 5 Seconds Accurately!

On all Jobs...this instrument is invaluable for balancing hot water heating systems, reading floor, wall or ceiling temperatures, checking refrigerated coils, insulation and all other low temperature surfaces.

Quick Accuracy...the 2300 assures the highest standards of speed, accuracy and dependability—you can read most low surface temperatures in 3 to 5 seconds.

Saves Money...the speed and precision eliminate time-wasting rechecking. It is a direct reading unit—no conversion tables, balancing slide wires or batteries are necessary.

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WE HEAR THAT . . .

▶ A two day open house, November 13 and 14, celebrated the 20th anniversary of the *AIRTEMP DIV.* of the *CHRYSLER CORP.* The observance was marked by the formal opening of two new plant additions completed recently as part of a multi-million dollar expansion program initiated in 1953.

Visitors numbering more than 10,000 inspected the newly enlarged plant. Guests included employees and their families, press representatives, city officials, local civic and business leaders and residents of the Dayton area.

▶ *TUBE TURNS* has announced the reorganization of its sales department. "The move," says *JOHN G. SEILER*, executive vice president and general sales manager, "is designed to improve marketing procedures and customer services, and it recognizes the special capabilities of various members of the sales staff.

▶ *THE TRANE CO.* has announced the completion of a new plant addition to facilitate the fabrication and distribution of its expanding air conditioning and refrigeration lines.

▶ Executive offices and testing laboratories of *SCULLY SIGNAL CO.* have been moved to new headquarters at 174 Green St., Melrose 76, Mass. Scully took over manufacturing space at the same site a year ago.

▶ At the present rate of increase—276,217 tons in 1946 to 576,068 tons in 1953—the industry annual shipments of alloy steel tubing should reach a total of one million tons by 1960, according to *EDWARD A. LIVINGSTONE*, vice president in charge of the tubular products division of *THE BABCOCK & WILCOX CO.* To meet this increasing demand, the division has recently completed a four-year expansion program which has more than doubled its steel-making facilities and provided a capacity of about 23,000 ingot tons per year, Mr. Livingstone says.

▶ A fully equipped station wagon is being used by *BORNQUIST, INC.*, district representatives for *BELL & GOSSETT CO.*, to show the manufacturer's line of forced water heating and cooling equipment, centrifugal pumps, heat exchangers and refrigeration equipment in the Chicago area.

▶ A representative group of the 13,000 scientists and engineers engaged full-time in governmental, industrial and educational aspects of atomic energy activity have organized the *AMERICAN NUCLEAR SOCIETY*, with headquarters at 329 W. 41st St., New York City.

WE HEAR THAT

Continued

▶ An *INDUSTRIAL WASTES DIV.* has been formed by *KAIGHIN & HUGHES, INC.*, Toledo piping and mechanical contractors. Increasing problems caused by disposition and treatment of waste materials by industry have prompted the move.

▶ *LUNKENHEIMER CO.'s* program of consolidation and expansion has as its focal point the company's Fairmount plant at Cincinnati. A plant devoted to iron and steel valve machining operations will be built here.

▶ *MITCHELL MFG. CO.'s* 1955 model room air conditioner has been awarded the *U.S. TESTING CO.* Certified Merchandise Seal. The award is based upon performance tests under actual use conditions.

▶ *A. M. BYERS CO.* will install new type facilities for production of wrought iron pipe in sizes comprising 45 to 50 percent of its total pipe production, in order to reduce production costs and improve quality of production. These new facilities will cost up to $2 million.

▶ *CONNOR ENGINEERING CORP.* manufacturer of ceiling air diffusers and air purification equipment, is enlarging its production facilities with a 20,000 sq ft plant addition.

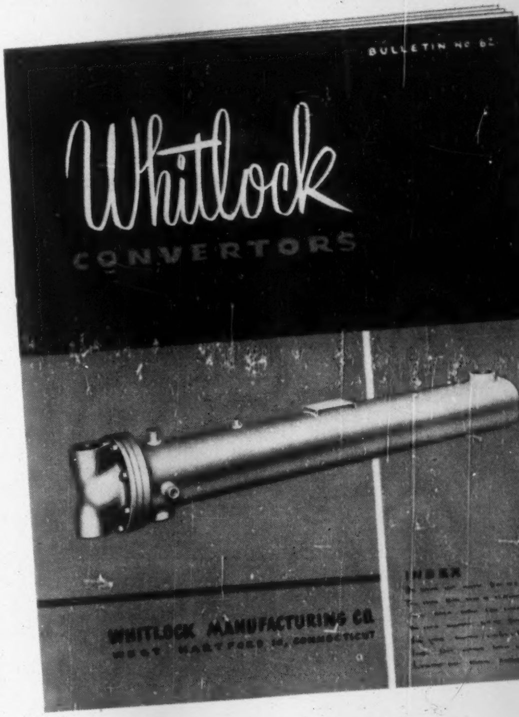
▶ In production at *CORY CORP.'s* Grayslake, Ill. plant is its 1955 line of "Fresh'nd Aire" window room air conditioners. Acquired 18 months ago, this plant was the subject of an improvement program late in 1953.

▶ *TYPHOON AIR CONDITIONING CO., INC.* recently moved into a new plant at 505 Carroll St., Brooklyn, N.Y. The new plant provides 100,000 sq ft of factory floor space, more than doubling the company's previous facilities.

▶ *WOLVERINE TUBE, DIV. OF CALUMET & HECLA, INC.* has announced new mill depots in Rochester, N.Y., Charlotte, N.C. and Dallas to serve customers in those territories. The depots stock seamless nonferrous water tube, automotive tube and refrigeration tube.

▶ Construction work at the new $3 million Long Beach, Calif. plant of *GRAYSON CONTROLS DIV.* of *ROBERTSHAW-FULTON CONTROLS CO.* has been completed. The new plant, double the size of previous facilities, is scheduled to begin operations in January.

Need Convertors?



BULLETIN NO 62

Whitlock

CONVERTORS

WHITLOCK MANUFACTURING CO.

WEST HARTFORD 10, CONNECTICUT

INDEX

With this new bulletin
it's EASY to select the size you want

Here's a new reference book specially arranged to help you select and specify Convertors. Right at your finger tips it provides complete information . . . including installation data . . . on our extensive line of Convertors. The tables are new and different. They have been carefully developed for your convenience in determining the right unit quickly. Be sure to get your copy of Bulletin 62 and keep it at hand for reference. Fill in the coupon and mail it today.

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WHITLOCK Designs and builds: bends, coils, condensers, coolers, heat exchangers, heaters, piping, pressure vessels, receivers, reboilers.

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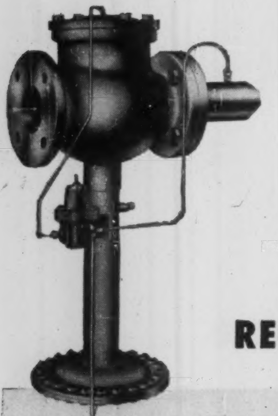


for more accurate pressure control the NEW Klipfel

PILOT-OPERATED
REDUCING VALVE
No. 933

QUICK ACTING FOR MINIMUM PRESSURE VARIATION

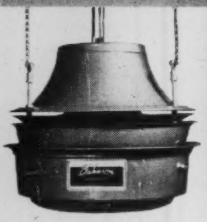
When you need "on-the-button" steam pressure reduction, specify the new Klipfel Pilot-Operated Reducing Valve. Although extremely sensitive, its simple operation insures trouble-free service. Downstream pressure is sensed by the diaphragm of the pilot valve. The pilot valve uses upstream pressure to open the main valve if downstream pressure is too low; if too high, pressure is bled off to partially close main valve. The next time you order a reducing valve, get the new standard for accurate control and low cost operation . . . Klipfel No. 933 Reducing Valve. Detailed literature on request.

Klipfel VALVES, INC.
1075 Lincoln Ave., Hamilton, Ohio
Export Office: 1010 Schaff Bldg., Phila. 2, Pa.

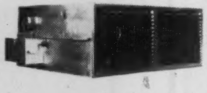
Highest Capacity at Lowest Cost...

BAHNSON HUMIDIFIERS

A TYPE FOR EVERY INDUSTRIAL NEED



TYPE E: Quickly installed; evaporates up to 3 gph with ¼ hp motor; ideal for small areas.



TYPE BA: Extremely versatile, for large areas. Water or steam units with capacity to 30 gph.

- Fully automatic
- Trouble-free
- No floor space
- Any capacity
- Free, complete engineering service

Write for specific recommendations, or get details on complete line in Catalog H-3

Bahnson
COMPANY
WINSTON-SALEM, N. C.

AIR CONDITIONING • HUMIDIFICATION

WE HEAR THAT

Continued

▶ *E. I. DU PONT DE NEMOURS & CO.* has established a New York office to handle sales of "Freon" fluorinated hydrocarbon refrigerants and aerosol propellents. Increased production has permitted the company's restocking of small cylinder quantities of "Freon-22" monochlorodifluoromethane in 29 regional warehouses.

▶ To prove the strength and durability of *THE GEORGE EVANS CORP.* filter, a model was tested to show it withstanding of a 1 1/8 in. stream of water under 65 lb pressure at 300 gpm.

▶ *AMERICAN BLOWER CORP.* has opened direct factory branch offices in Portland, Ore. and Ft. Wayne headed by *W. S. COOPER* and *J. W. JOHNSON*, respectively.

▶ *DR. ALEXANDER L. FEILD*, associate director of research for *ARMCO STEEL CORP.*, has been named Sauveur Medalist for 1954. The Sauveur Medal, established in 1934 by the American Society for Metals, recognizes achievements which have made contribution to the knowledge of metals.

▶ *ARMSTRONG CORK CO.* has created a separate Insulation Div., headed by *A. E. PEARCE* as general sales manager. The division is composed of two departments—industrial insulation and equipment insulation.

▶ The merger of the C. L. Rayfield Co. with the Staffco Engineering Co. to form the *RAYFIELD-STAFFCO BURNER CO.* has been announced by *E. A. FREUDIGER*, former head of Rayfield.

▶ *AMERICAN DISTRICT STEAM CO., INC.* has moved its Philadelphia office to 1714 Lincoln-Liberty Bldg., Broad and Chestnut Sts.

▶ *ARGONNE NATIONAL LABORATORY*, operated for the Atomic Energy Commission by the University of Chicago, has selected *SARGENT & LUNDY*, Chicago, as the architect-engineer for the design of the Experimental Boiling Water Reactor, part of a program for development of competitive electrical power from nuclear fuel. *ALLIS-CHALMERS MFG. CO.* will design, develop, construct and install the power generation, heat transfer, and special equipment for the power cycle.

▶ *E. W. MACK* and *ROBERT E. CAPLAN* have organized and own outright the *WABASH CORP.*,

WE HEAR THAT

Continued

2300-18 S. Western Ave., Chicago. Complete plant, receivables, inventory, patents, etc. have been purchased from the former owners. They will sell to wholesalers only.

▶ *J. F. PRITCHARD & CO.* has moved its offices to its own new building at 4625 Roanoke Parkway, Kansas City 12, Mo.

▶ *PERFECTION STOVE CO.* plans a new program by which it will merchandise its air conditioners on a five year cost amortization basis. The company also plans to lease these units for the same period or longer.

▶ *GENERAL ELECTRIC CO.* has produced more than 100 million fractional horsepower motors since 1902. Executives predict that the company will double this total by 1965.

▶ The newly formed firm of *GHK ASSOCIATES* is staffed to expedite and direct engineering projects and surveys involving mechanical, chemical, electrical, civil, structural and production engineering. Address is 15390 91 Livernois Ave., Detroit, Mich.

▶ *The HEATING, PIPING AND AIR CONDITIONING CONTRACTORS DETROIT ASSN.* has established a mechanical estimating school.

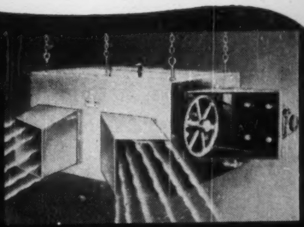
▶ *PRAT-DANIEL CORP.* and the Day and Night Div. of *AFFILIATED GAS EQUIPMENT, INC.* have announced the acquisition by Prat-Daniel of the patents, sales and manufacturing rights to "Overhead Panelray," a gas fired infrared industrial and commercial heating device.

▶ A cooling tower laboratory operated by *J. F. PRITCHARD & CO.* is searching for the equation of cooling tower design. Laboratory engineers hope to be able to evolve an equation which will enable them to predict the performance of tower decking without actual testing.

The immediate objective is to measure cooling tower performance, using many arrangements and construction types of materials and to determine the performance characteristics of different types of deck filling.

▶ The formation of *THE WALLACE CO.* for the sales, manufacture and installation of industrial refrigeration equipment, has been announced. Offices have been established at 1188 Main St., Bridgeport, Conn.

HERE'S YOUR ANSWER TO
LARGE AREA
SPACE HEATING!



CHROMALOX
Blower Type
UNIT HEATERS

FOR HEAVY-DUTY HEATING IN FACTORIES, WAREHOUSES, OFFICES

Ceiling mounted CHROMALOX Electric Blower-Type Heaters are your quick, easy answer to space heating! Twin centrifugal fans, driven by a 3-phase motor, distribute warmth evenly over large areas. Air ducts can be used to convey heated air to desired locations. Automatic thermal cutout assures protection against overheating. 51,180 to 136,480 BTU output per hour.

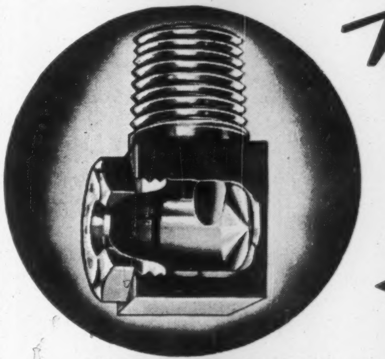
HAVE A HEATING PROBLEM OF ANY KIND?

Then write for Catalog 50. It's loaded with information on many of the 15,000 types, sizes and ratings of Chromalox Heating Units and Equipment.

Edwin L. Wiegand Co.,
7610 Thomas Boulevard Pittsburgh 8, Pa.

CHROMALOX 18-8

ELECTRIC HEAT FOR MODERN INDUSTRY



Monarch
NOZZLES
for
AIR WASHERS

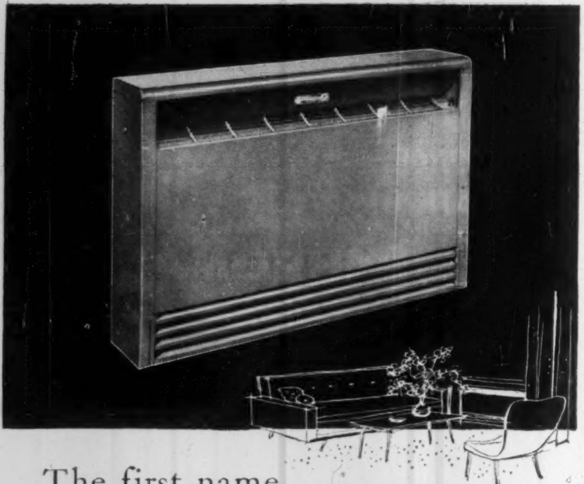
These are "non-clogging" nozzles with a single large tangential lead hole to the swirl chamber that will never clog from any impurities small enough to pass through the orifice. Swirl chamber is conical on both ends and pivots liquid like a top to produce an exceptionally fine, evenly distributed, balanced spray of about 80° included angle. Wider spray angles up to 130° can be furnished to order.

Standard material Brass. Also available in Stainless Steel and Monel. Pipe sizes from $\frac{1}{8}''$ to 1". $\frac{1}{4}''$ size is 1-5/16" long and made from $\frac{3}{8}''$ square stock.

Write for Catalog 6-A

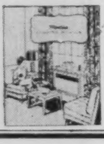
Monarch MFG. WORKS, INC.
2523 E. ONTARIO ST.
PHILADELPHIA 34, PA.

Canadian Agents: (Except B.C.)
Canadian General Filters Ltd., Toronto 16, Canada



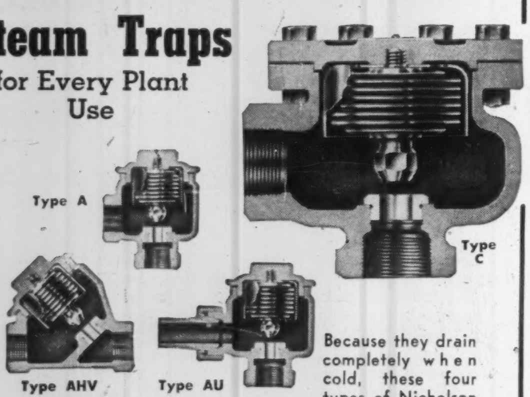
The first name in heating is still Modine
CONVECTOR RADIATION

For those who want modern heating at its finest, there's only one answer — Modine convector radiation. Unmatched performance is combined with quiet beauty . . . long life with uniform, healthful heating. Your choice of enclosure styles for free-standing, recessed or for wall-hung installation.



For complete information, call the Modine representative listed in your classified phone book today. Or write for Bulletin SA-54, Modine Mfg. Co., 1509 DeKoven Ave., Racine, Wisconsin. R-1236

NICHOLSON MAKES
FREEZE - PROOF
Steam Traps
for Every Plant Use



Because they drain completely when cold, these four types of Nicholson steam traps are positively freeze-proof. Can be freely installed outdoors. Universally recommended for use in lines which need not be in continuous use during cold weather, because they are freeze-proof and because their 2 to 6 times average drainage capacity results in minimum heat-up time. The non-air-binding feature of Nicholson traps also notably facilitates heat transfer in severe weather. Sizes 1/4" to 2"; pressures to 300 lbs.

BULLETIN 853
198 Oregon St., Wilkes-Barre, Pa.

W. H. NICHOLSON & CO.
TRAPS · VALVES · FLOATS

WE HEAR THAT

Continued

▶ *WHEELING STEEL CORP.* has sent to its 11,000 stockholders an illustrated brochure describing the $151 million improvement program which began in 1946. The brochure describes the company situation prior to 1946 and outlines the improvement program undertaken. Phases dealt with are: Increase of steel pipe production capacity by nearly 150,000 tons per year at the Benwood, W.Va. works. Installation of a new continuous galvanizing line at the Martins Ferry, Ohio factory, and plans to build a second line which, it is predicted, will triple production of the galvanized product called "SofTite."

▶ *THE PEERLESS ELECTRIC CO.*, Warren, Ohio, has purchased the physical assets of the Sherman Electric Co., Inc., including license to manufacture and sell all products covered by Sherman patents. These patents cover electronic devices, one of which was developed to check and correct faulty thermocouple circuits.

▶ To celebrate the manufacture of the millionth "Yarway" impulse steam trap, the *YARNALL-WARING CO.* is sending out at random in regular shipments, 100 traps specially packaged in gold bags.

THE NEW
DISTRICT HEATING
HAND BOOK
THIRD EDITION

An Entirely New Volume — 529 Pages
15 CHAPTERS — 6"x9 1/4"

GROWTH AND PRESENT STATUS
ECONOMICS OF DISTRICT HEATING
GENERAL DATA
DISTRICT HEATING PLANTS
WATER CHEMISTRY AND CORROSION
STEAM DISTRIBUTION
METERING
BUILDING HEATING SYSTEMS
CONSUMERS' PROCESS EQUIPMENT
CONSUMERS' ACCESSORY EQUIPMENT
ESTIMATING STEAM REQUIREMENTS
ECONOMICAL USE OF STEAM
RATES
SALES ACTIVITIES
HOT WATER FOR DISTRICT HEATING

Price $7.00

NATIONAL DISTRICT HEATING ASSOCIATION
827 N. EUCLID AVE., PITTSBURGH 6, PA.

MEETINGS & CONVENTIONS

AMERICAN SOCIETY OF HEATING & VENTILATING ENGINEERS—61st annual meeting. January 24-27, Benjamin Franklin and Bellevue-Stratford Hotels, Philadelphia. Headquarters: ASHVE, 62 Worth St., New York 13.

INTERNATIONAL HEATING & VENTILATING EXPOSITION—The Air Conditioning Exposition. January 24-28, Commercial Museum and Convention Hall, Philadelphia. Management: International Exposition Co., 480 Lexington Ave., New York 17.

PLANT MAINTENANCE & ENGINEERING CONFERENCE—January 24-26, International Amphitheater, Chicago. Registration: Clapp & Poliak, Inc., 341 Madison Ave., New York 17.

INSTRUMENTATION FOR THE PROCESS INDUSTRIES—January 26-28, School of Engineering, Chemical Engineering Dept., Texas A&M, College Station, Texas. Registration fee is $10.00 at the Memorial Student Center on the campus. There is no pre-registration.

McINTYRE-SARANAC CONFERENCE—February 7-9, Town Hall, Saranac Lake, N.Y. Write c/o the conference, P.O. Box 551, Saranac Lake.

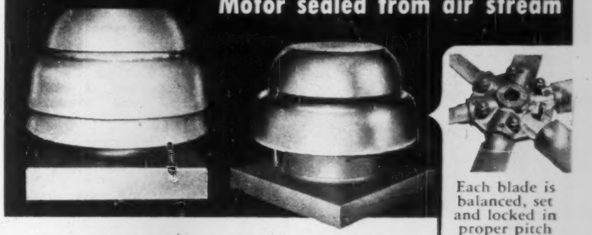
INDUSTRIAL VENTILATION CONFERENCE—February 14-17, Kellogg Center, Michigan State College, East Lansing, Mich.

NATIONAL ASSOCIATION OF CORROSION ENGINEERS, Tulsa Section—6th Annual Corrosion Short Course for Pipeliners. February 16-18, Mayo Hotel, Tulsa, Okla. Thomas M. Ragland, Phillips Petroleum Co., is chairman of the course.

NATIONAL ASSOCIATION OF CORROSION ENGINEERS—Corrosion short course. March 1-4, Carolyn P. Brown Memorial Center, University of Tennessee, Knoxville. Registration: A. B. Campbell, c/o the association, 1061 M & M Bldg., Houston 2.

11*TH ANNUAL CONFERENCE AND EXHIBITION OF THE NATIONAL ASSOCIATION OF CORROSION ENGINEERS*—March 7-11, Palmer House, Chicago. Registration: A. B. Campbell, c/o the association, 1061 M & M Bldg., Houston 2.

COOK VENTILATORS
now with BLOWER or PROPELLER
Easy to install • All aluminum • Low silhouette
Motor sealed from air stream

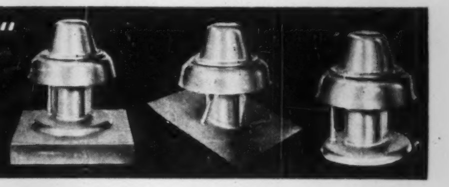


Each blade is balanced, set and locked in proper pitch by taper-pin bolt.

Blower type, Model BV from 9" to 21". Backwardly inclined impeller, non-overloading.

Propeller type, Model FV from 12" to 24". Thousands of Cook-built propellers are in daily use.

7",9" or 10" Blower Roof Ventilator Model R



All models direct drive . . . damper optional

Model R with square base

Model R with slope base

Model R with round base

COOK

Duct Fan **Exhaust Fan** **Man Cooler** **Roof Ventilator**

Write for catalog HP, Loren Cook Co., Berea, Ohio

pounds
NOT GUESSES

Install BUILDERS SHUNTFLO STEAM METERS right in your steam lines. Keep track of steam costs by seeing where steam is going and how much. Shuntflo Meters available in Model SMKS (shown) for 2" to 14" lines — Model SMDH for 1" and 1½" lines. Write for Shuntflo Bulletins. Builders-Providence, Inc. (Division of B-I-F Industries, Inc.), 381 Harris Ave., Providence 1, R. I.

BUILDERS-PROVIDENCE
DIVISION OF B-I-F INDUSTRIES, INC.
METERS FEEDERS CONTROLS

WATER FILTERS

All of the outstanding qualities that have made **MARVEL SYNCLINAL FILTERS** the overwhelming choice in the filtration of hydraulic oils and other oil base liquids have been adapted to provide the same efficiency in the filtration of water.

Balanced Synclinal Design means longer periods of efficient filtration and productive operation.

STURDY CONSTRUCTION

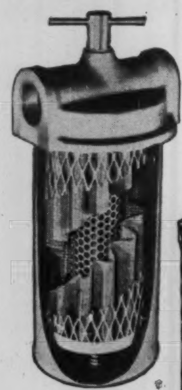
to withstand use under rugged conditions, yet simple enough to allow any workman to easily disassemble, clean and reassemble on the spot, in a matter of minutes.

A SIZE FOR EVERY NEED

Available in line and sump type units in capacities from 5 to 100 G.P.M. Permanent type Menel metal insert ranging in mesh sizes from coarse 30 to fine 200.

Complete data and further information are contained in WATER CATALOG #300.

Write for your copy



LINE TYPE (Cutaway)
IMMEDIATE DELIVERY!

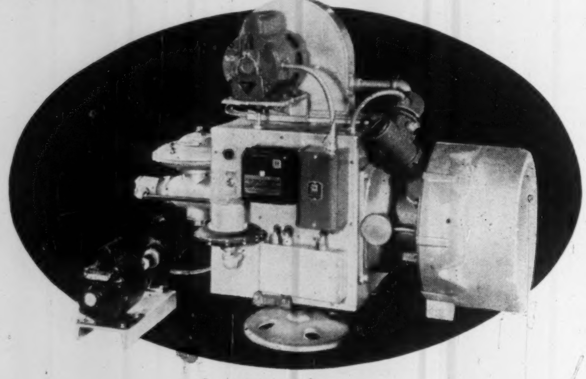
SUMP TYPE
(Cutaway)

Marvel not only delivers a top grade filter in both quality and performance, but DELIVERS IMMEDIATELY. If desired, shipments are made on same day orders are received.

MARVEL Engineering Company

627 W. Jackson Blvd., Chicago 6, Ill.
PHONE: Franklin 2-4431

NEW completely automatic gas-oil burner



In seven sizes . . .

for firing rates up to 3,000,000 BTU

No fear of being "half-safe"! The new Eclipse SP Combination Gas-Oil Burner has UL approval, is rated "okay" by city boards in Omaha, New York, Minneapolis, Cleveland, Dayton, St. Louis. *No extras to buy and install!* Burner comes ready to fire. You just connect the power source, limit controls, and gas-oil lines. True rotary combustion assures maximum heating efficiency. *No need to delay!* Start saving time and money by converting obsolete burner equipment to automatic dual-fuel firing. Write for bulletin R-100.

ECLIPSE FUEL ENGINEERING CO., 1139 Buchanan Street, Rockford, Illinois
ECLIPSE FUEL ENGINEERING CO. OF CANADA, LTD., TORONTO, ONTARIO

Eclipse BURNERS

MEETINGS & CONVENTIONS *(Continued)*

OIL-HEAT INSTITUTE OF AMERICA—33rd annual convention. Tentatively April 4-7, Edgewater Beach Hotel, Chicago. OHI headquarters, 500 Fifth Ave., New York 36.

NATIONAL DISTRICT HEATING ASSOCIATION—46th annual meeting. May 23-26, Edgewater Beach Hotel, Chicago. The association is at 827 Euclid Ave., Pittsburgh 6.

AMERICAN SOCIETY FOR TESTING MATERIALS—June 26-July 1, Chalfonte-Haddon Hall, Atlantic City, N.J. 1955 spring meeting—January 31-February 4, Netherland Plaza Hotel, Cincinnati. The society is at 1916 Race St., Philadelphia 3.

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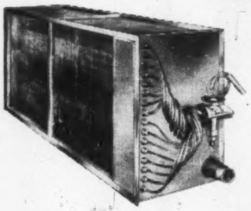

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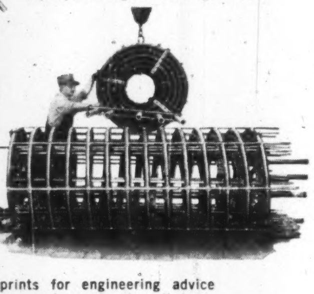

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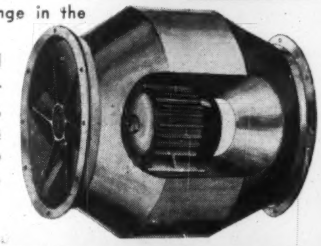

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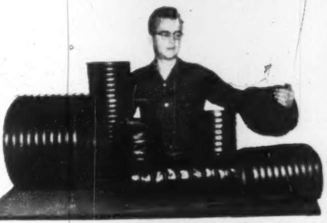

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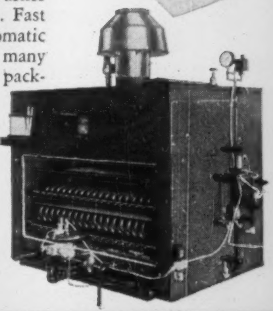

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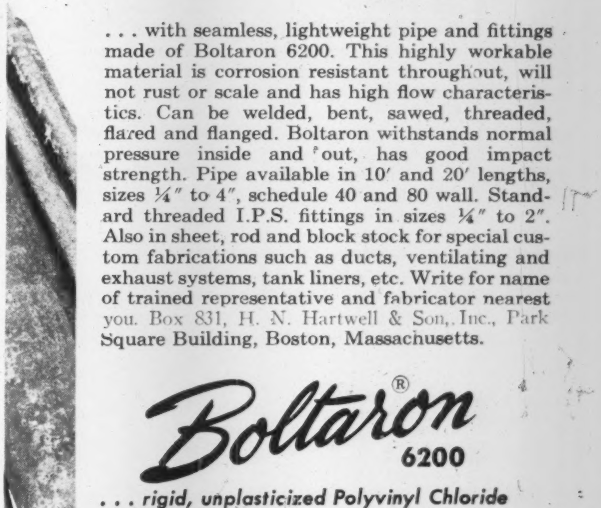

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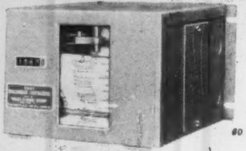

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PROCEEDINGS OF THE 5*th ANNUAL SOUTHEASTERN SYMPOSIUM ON INDUSTRIAL INSTRUMENTATION*, Bulletin Series No. 67—48 pp., ill. Florida Engineering and Industrial Experiment Station, University of Florida, Gainesville.

CURRENT CONCEPTS ON AIR POLLUTION—By W. C. L. Hemeon, Engineering Director, Industrial Hygiene Foundation of America, Inc., Mellon Institute, University of Pittsburgh, 4400 5th Ave., Pittsburgh. 28 pp., ill.

PIPING, TRAPPING AND VENTING STEAM AND HOT WATER UNIT HEATERS—8 pp., ill. Bulletin 15 of The Industrial Unit Heater Association, 2159 Guardian Bldg., Detroit 26.

THE CARE AND MAINTENANCE OF STEAM AND HOT WATER UNIT HEATERS—4 pp., ill. Bulletin 12 of The Industrial Unit Heater Association, 2159 Guardian Bldg., Detroit 26.

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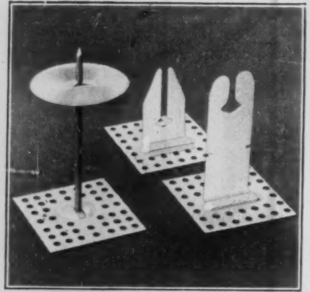

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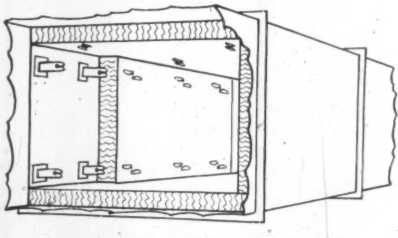

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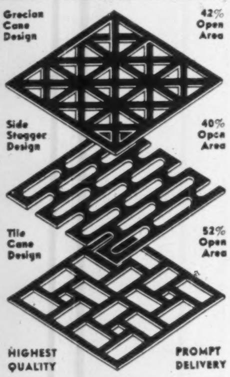

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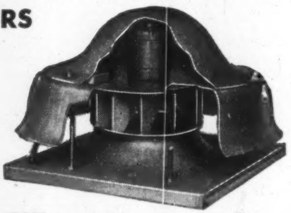

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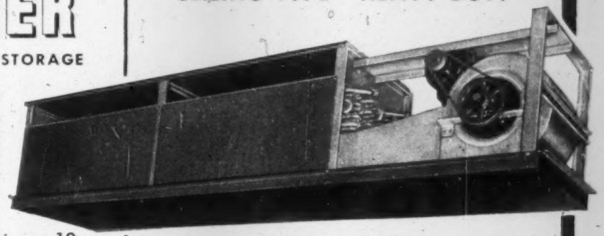

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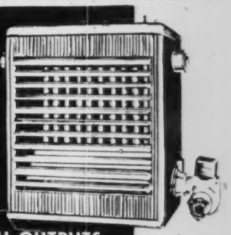

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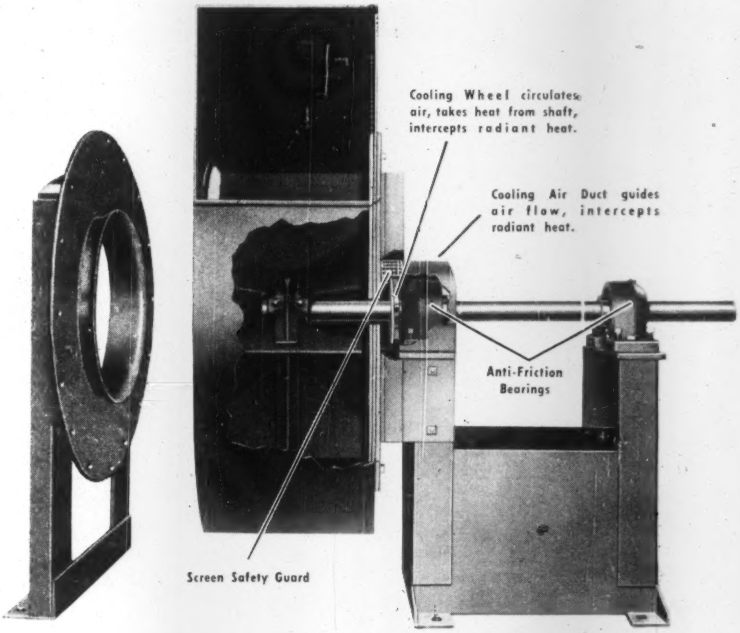
Cooling Wheel circulates air, takes heat from shaft, intercepts radiant heat.
Cooling Air Duct guides air flow, intercepts radiant heat.
Anti-Friction Bearings
Screen Safety Guard

New Clarage Type XL Fan shown in "opened up" view is typical of the sizes which provide universal discharge.

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Clarage's new Type XL Fans equipped with AIR Cooled Bearings!

FOR TEMPERATURES UP TO 750° F., here's a simple, dependable, inexpensive feature available on standard Clarage fans. Costlier water cooled bearings NOT required. By all means, on your next "hot" job consult the Clarage sales engineer about this money-saving optional feature.

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Learn about the high efficiency, rugged construction, and in-the-field adaptability of this exceptional fan equipment by requesting Bulletin 702. CLARAGE FAN COMPANY, Kalamazoo, Michigan.

NOTE: For heavier-duty service or temperatures above 750° F., this and other types of Clarage fans can be provided with water cooled bearings.

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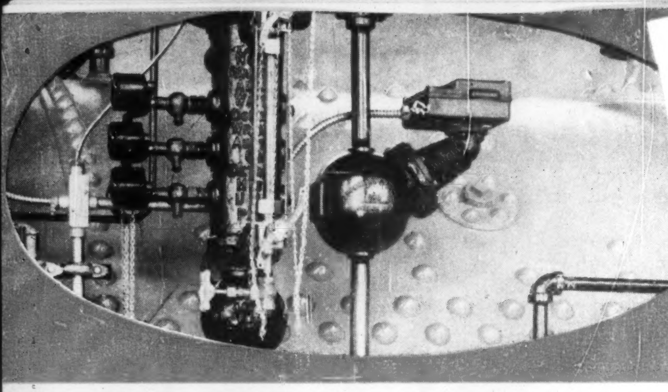

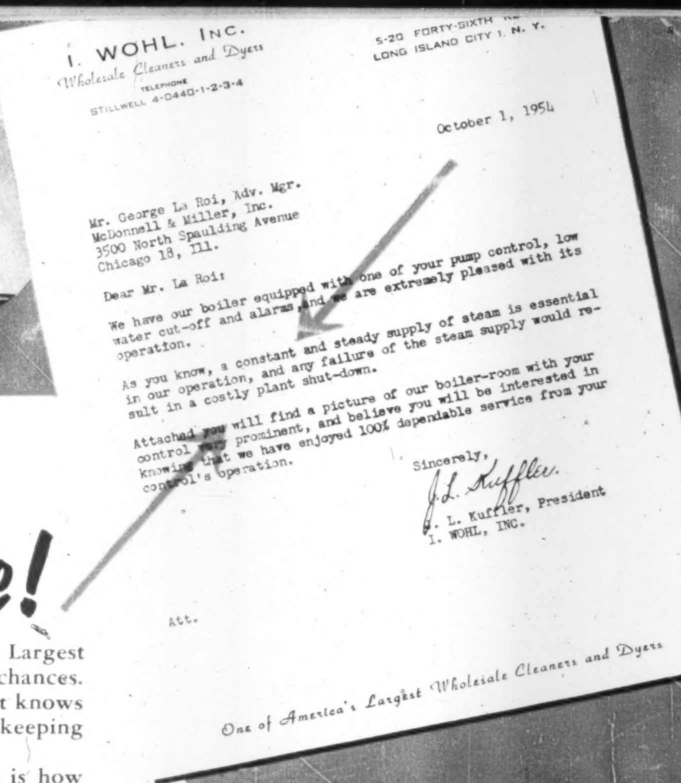

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Wholesale Cleaners and Dyers
TELEPHONE
STILLWELL 4-0440-1-2-3-4

5-20 FORTY-SIXTH
LONG ISLAND CITY 1. N. Y.

October 1, 1954

Mr. George La Roi, Adv. Mgr.
McDonnell & Miller, Inc.
3500 North Spaulding Avenue
Chicago 18, Ill.

Dear Mr. La Roi:

We have our boiler equipped with one of your pump control, low water cut-off and alarms, and we are extremely pleased with its operation.

As you know, a constant and steady supply of steam is essential in our operation, and any failure of the steam supply would result in a costly plant shut-down.

Attached you will find a picture of our boiler-room with your control very prominent, and believe you will be interested in knowing that we have enjoyed 100% dependable service from your control's operation.

Sincerely,
J. L. Kuffler.
J. L. Kuffler, President
I. WOHL, INC.

Att.

One of America's Largest Wholesale Cleaners and Dyers

No paralyzing shut-downs here!

I. Wohl, Inc. didn't grow to be "One of America's Largest Wholesale Cleaners and Dyers" by taking unnecessary chances. Their letter to us tells the story. The Wohl management knows that an unfailing steam supply is the first essential of keeping operations under way.

You know it too . . . but what you may not realize is how unexpectedly a boiler shut down can occur when the water level is not controlled by modern equipment. Thousands of plants, like I. Wohl, Inc., have found McDonnell Boiler Water Level Control the most economical and dependable way to keep the boiler going. Read the facts; then ask for simple installation instructions that will show you how easy it is to end the shut-down shudders.

McDONNELL & MILLER, INC., 3500 N. SPAULDING AVE., CHICAGO 18, ILL.

Doing One Thing Well

✓ What could be simpler?

The accompanying diagram shows the simple hook-up of the widely used McDonnell No. 150 Pump Control and No. 27 Make-up Water Feeder for boilers like yours (up to 150 psi.). The No. 150 starts and stops the pump as the water rises and falls, to hold the level within close limits. The No. 27 is installed on the receiver to supply make-up water—assure an ample level of water in the receiver at all times. A second switch is provided on the No. 150 for cutting off burner and sounding low water alarm in the event of an emergency such as current interruption in the pump circuit or failure of water supply.

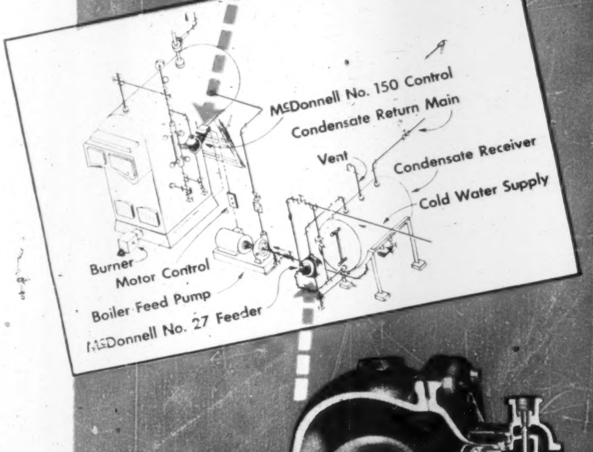
By holding the water level within close limits, the McDonnell hook-up achieves steaming efficiency and fuel economy that would make it a profitable investment even if there never were a threat of low water!

✓ —or more dependable?

Ability to stand up under the pressure and temperature of laundry and cleaning plant operation is attested by the success of hundreds of McDonnell installations. The two switches of the No. 150 are Underwriters' approved. Switch leads have heat-impervious, porcelain-bead insulation. Packless construction is provided by extra-heavy monel bellows. Float has extra-heavy shell. Entire mechanism is sealed to prevent tampering.

The No. 27 is equally rugged and dependable. It has large water feeding capacity; bronze and stainless steel valve mechanism. Every detail of construction speaks quality. Other make-up feeders are available to meet almost all conditions.

No. 150
PUMP CONTROL



No. 27
MAKE-UP
FEEDER

Your Jobber Stocks Them

McDONNELL *Boiler Water Level Controls*